

# MANUAL FOR OPERATION & MAINTENANCE OF METERED CARBON FILTER



*for Models:*

**W-G744EM**

**W-G844EM**

**W-G940EM**

**W-G1054EM**

**W-G1252EM**

**W-G1354EM**

**W-G1465EM**

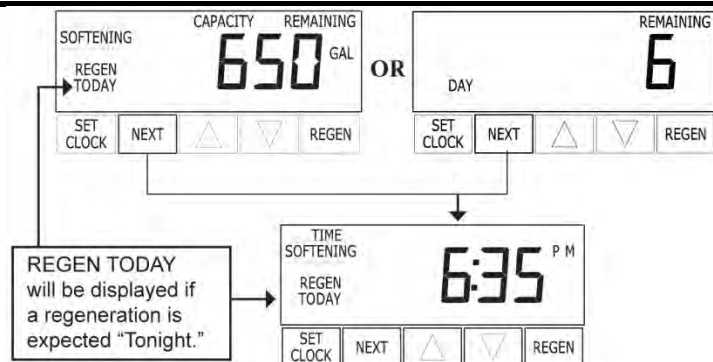
**W-G1665EM**

## VALVE OPERATION QUICK REFERENCE GUIDE

### General Operation

When the system is operating one of two displays will be shown. Pressing NEXT will alternate between the displays. One of the displays is the current time of day. The second display is one of the following: days remaining or gallons remaining.

If the system has called for a regeneration that will occur “tonight”, the words REGEN TODAY will appear on the display. When water is flowing through the system the word “FILTERING” flashes on the display.



### Set Time of Day

In the event of a prolonged power outage, time of day flashes, indicating that it needs to be reset. All other information will be stored in memory no matter how long the power outage. Please complete the steps as shown to the right.



- Step 1U:** Press SET CLOCK
- Step 2U:** Current Time (hour): Set the hour of the day using ▲ or ▼ buttons. AM/PM toggles after 12. Press NEXT to go to step 3&U
- Step 3U:** Current Time (minutes): Set the minutes of the day using ▲ or ▼ buttons. Press NEXT to exit Set Clock. Press REGEN to return to previous step.

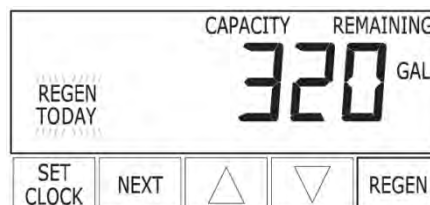
### Manual Regeneration

**To initiate a generation at the preset delayed regeneration time of day:** Press and release “REGEN”. The words “REGEN TODAY” will flash on the display. If the “REGEN” button was pressed in error, pressing again will cancel the request.

**To initiate manual regeneration immediately:** Press and hold “REGEN” button for three seconds. System will begin regeneration immediately. Request cannot be cancelled.

The control valve may be stepped through the various regeneration cycles by pressing the “REGEN” button.

“REGEN TODAY” will flash if a regeneration is expected “Tonight”.



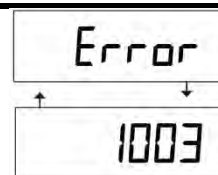
### Regeneration Mode

When the filter begins to regenerate, the display will change to include information about the step of the regeneration process and the time remaining for that step to be completed. The system runs through the steps automatically and will reset itself to provide treated water when the regeneration has been completed.



### Error Message

If the word “ERROR” and a number are alternately flashing on the display, check the trouble shooting section of this manual to identify the error.



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## DESIGN BASIS & SPECIFICATIONS

Table 1 – Specifications

| Model No.* | Flow Rate** (GPM)    |                       | Backwash Flow** (GPM) | Volume of Media (ft <sup>3</sup> ) |                        | Resin Tank (Dia" x H") | Valve Size | In/Out Conn. |
|------------|----------------------|-----------------------|-----------------------|------------------------------------|------------------------|------------------------|------------|--------------|
|            | 5gpm/ft <sup>2</sup> | 15gpm/ft <sup>2</sup> |                       | Carbon (Only)                      | Total (Incl. Underbed) |                        |            |              |
| W-G744EM   | 1                    | 4                     | 2.2                   | 0.50                               | 0.60                   | 7x44                   | 1"         | 1"           |
| W-G844EM   | 2                    | 5                     | 2.7                   | 0.60                               | 0.70                   | 8x44                   | 1"         | 1"           |
| W-G940EM   | 2                    | 6                     | 3.2                   | 0.75                               | 0.85                   | 9x40                   | 1"         | 1"           |
| W-G1054EM  | 2                    | 7                     | 4.2                   | 1.25                               | 1.45                   | 10x54                  | 1"         | 1"           |
| W-G1252EM  | 4                    | 12                    | 6.5                   | 1.75                               | 2.05                   | 12x52                  | 1"         | 1"           |
| W-G1354EM  | 4                    | 14                    | 7.5                   | 2.00                               | 2.30                   | 13x54                  | 1"         | 1"           |
| W-G1465EM  | 5                    | 16                    | 7.5                   | 3.00                               | 3.50                   | 14x65                  | 1"         | 1"           |
| W-G1665EM  | 7                    | 21                    | 15                    | 3.50                               | 4.00                   | 16x65                  | 1"         | 1"           |

\* Filters are available with USA or European style plugs and voltages. Please add the appropriate voltage code to the end of the model no. when ordering.

120V AC/60Hz with USA plug = **US** - Example: W-G744-US

\*\* Volume of Media is approximate and includes underbedding.

\*\*\* 5 gpm per sq. ft. of media is the best design condition for filtration. For relatively clean water, you may go up to design criteria of 15 gpm per sq. ft. Backwash flow rate based on 25 psi pressure drop.

### Specifications

- Vessel rated at 150 psi max. operating pressure, 120°F max. operating temp.
- All Systems Automatic

## GENERAL INFORMATION AND SAFETY

### DISCLAIMER:

The information contained in this document is subject to change without notice. Applied Membranes, Inc. shall not be liable for technical or editorial omissions made herein; nor for incidental or consequential damages resulting from the furnishing, performance, or use of this material.

### READ THIS MANUAL:

Prior to operating or servicing this unit, this manual must be read and understood. If anything is not clear, call for assistance before proceeding. Keep this and other associated manuals for future reference and for new operators or qualified service personnel.

### ⚠ USE PROPER POWER CONNECTIONS:

Use proper wiring and connection methods to satisfy local electrical codes. **SHOCK HAZARD:** Connect this unit to a properly grounded connection in accordance with the National Electrical Code. **DO NOT**, under any circumstances, remove the ground wire or ground prong from any power plug. Do not use extension cords or an adapter without proper consideration.

### ⚠ SERVICE WARNING:

To prevent electrical shock, disconnect power to the system prior to servicing.

### ⚠ WARNING:

Do not make any alteration or modification in the wiring or plumbing of the system. This can result in damage to the system and cause injury to operators or users.

### ⚠ WARNING:

Flush the system for at least 30 minutes before use to remove all chemicals present.



### CAUTION:

Never let the carbon filter freeze. Freezing can damage the resin tank.

## INSTALLATION

Unpack Carbon Filter. Inspect assemblies for damage (cracked couplings, broken or split pipes, loose straps, etc.).

### LOCATION

Select a location for the Carbon Filter with adequate clearance from walls and other equipment to allow access on all sides of the tank. The unit must be located near a drain able to accommodate the backwash flow rate of your unit (see the table on page 3). This is in addition to any other equipment sharing the drain.

A grounded power supply of the appropriate voltage and a local disconnect switch is required.

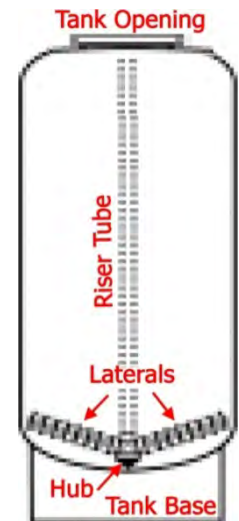
**⚠ Caution:** The unit must not be located near any corrosive chemicals, or in an area where the temperature may exceed 113°F (45°C).

**⚠ Warning:** The power supply must be properly grounded to avoid injury from electrical shock.

*If media shipped unloaded (packaged separately outside of the tank) then continue with the loading instructions. If the carbon filter was shipped loaded, please skip to plumbing.*

### LOADING THE MEDIA

1. Place tank on a level, solid surface in the correct position for installation. Lift the riser tube from the tank, keeping the attached hub within the opening of the tank. Within the tank, assemble the laterals onto the hub, twisting each lateral into the hub to lock securely. Gently lower the assembly to the bottom of the tank. The top of the riser tube should be about level with the top of the tank.
2. The “riser tube” inside the media/resin tank delivers treated water to your control valve. It will need to be temporarily covered with tape on the top end to prevent anything from falling down inside the tube during loading.
3. Step back and look at the tank to make sure it is standing straight, and not tilted. The black base on the bottom of the tank should also be straightened before filling the tank. If your tank is tilted, simply pick up the tank 2-3 inches off the floor and drop it gently (but firmly) down, favoring the side of the base that needs to be adjusted.
4. Before loading the media, fill the tank with 2-3 feet of water (or 1/3 full, depending on the tank size), to soften the fall of the rocks and prevent damage to the distributor. To load the media, use a funnel in the top of the media tank with the riser tube still inside. Make sure the riser tube is covered with tape to keep media out.
5. Scoop the media into the funnel, slowly letting it fall down inside the media tank around the riser tube. Fill the tank with the media provided, pouring the media in the following order (1st will end up on the bottom of the tank, last will end up at the top of the tank, etc.). *Note: The tank will be approximately 1/2 - 2/3 full after loading is complete. Refer to table on the following page for the proper quantities of each media.*
  - I. Gravel – YMGRVL11618 – 1 CF (100 lbs.) per bag
  - II. Carbon – YMC1240RCOAL – 1 CF (27.5 lbs.) per bag
6. Remove the funnel from the top of the tank, and the tape from the end of the riser tube. Brush any loose media off the top opening of the tank.
7. The bottom of the control valve has an opening with O-rings inside; lubricate the O-ring with a non-petroleum based lubricant. Position the valve over the top of the media tank, making sure the top of the riser tube inserts inside the opening in the bottom of the valve.
8. Screw the valve down into the media tank. Another person should hold the tank as the valve is being snugly tightened onto the tank. **Do not over-tighten.** Tighten until snug, tighten a bit more, and then STOP. The large o-ring will seal itself.





## RESIN QUANTITY PER MODEL

Table 2 – Resin Quantities

| Model No.*<br>(-US or -EU) | Gravel<br>$\frac{1}{16} \times \frac{1}{8}$<br>I | Carbon<br>II       |
|----------------------------|--|--------------------|
| W-G744EM                   | 0.1 CF (10 lbs)                                  | 0.5 CF (13.8 lbs)  |
| W-G844EM                   | 0.1 CF (10 lbs)                                  | 0.6 CF (16.5 lbs)  |
| W-G940EM                   | 0.1 CF (10 lbs)                                  | 0.75 CF (20.6 lbs) |
| W-G1054EM                  | 0.2 CF (20 lbs)                                  | 1.25 CF (34.4 lbs) |
| W-G1252EM                  | 0.3 CF (30 lbs)                                  | 1.75 CF (48.1 lbs) |
| W-G1354EM                  | 0.3 CF (30 lbs)                                  | 2.0 CF (55.0 lbs)  |
| W-G1465EM                  | 0.5 CF (50 lbs)                                  | 3.0 CF (82.5 lbs)  |
| W-G1665EM                  | 0.5 CF (50 lbs)                                  | 3.5 CF (96.25 lbs) |

## PLUMBING


### 1. Install connecting piping between raw water source and input pipe on control valve.


The installation fittings connect to the control valve or the bypass valve using nuts that only require hand tightening. Do not use a pipe wrench to tighten nuts on installation fittings. The split ring design, incorporated into the installation fittings allows approximately 2 degrees off axis alignment to the plumbing system. The installation fittings are designed to accommodate minor plumbing misalignments but are not designed to support the weight of a system or the plumbing.


When assembling the installation fitting package, connect the fitting to the plumbing system first and then attach the nut, split ring and o-ring. Heat from soldering or solvent cements may damage the nut, split ring or o-ring. Solder joints should be cool and solvent cements should be set before installing the nut, split ring and o-ring. Avoid getting primer and solvent cement on any part of the orings, split rings, bypass valve or control valve. Solvent cements and primers should be used in accordance with the manufacturer's instructions.

Slip the nut onto the fitting first, then the split ring second and the o-ring last. Hand tighten the nut. If the fitting is leaking tightening the nut will not stop the leak. Remove the nut, remove the fitting, and check for damage or misalignment of the o-ring.

Do not use pipe dope or other sealant on threads. Use teflon tape on threaded inlet, outlet and drain fittings. Teflon tape is not necessary on the nut connection or caps because of o-ring seals.

 **Note:** All plumbing is to be done in accordance with state and local codes.

 **Caution:** Before placing wall anchors to support piping ensure that no electrical conduit or wiring is located behind the intended mounting location.

 **Note:** The control valve, fittings and/or bypass are designed to accommodate minor plumbing misalignments but are not designed to support the weight of a system or the plumbing.

### 2. Install drain line from control valve to a free flowing drain.

If the drain line is a  $\frac{5}{8}$ " flexible polytube, slide the nut onto the polytube, then place the polytube insert into the end of the polytube and tighten the nut on to the  $\frac{3}{4}$ " drain line fitting. The nut is only designed for use with flexible polytube. Use other nuts if attaching different materials. (To access the drain line flow control, remove the locking clip by pulling it straight out. Pull fitting out and replace the locking clip so that it is not misplaced. The drain line fitting is pressed in and has an o-ring seal.)

### 3. Install piping between carbon filter output and point of use.

The installation fittings connect to the control valve or the bypass valve using nuts that only require hand tightening. Do not use a pipe wrench to tighten nuts on installation fittings. The split ring design, incorporated into the installation fittings allows approximately 2 degrees off axis alignment to the plumbing system. The installation fittings are designed to accommodate minor plumbing misalignments but are not designed to support the weight of a system or the plumbing.

When assembling the installation fitting package, connect the fitting to the plumbing system first and then attach the nut, split ring and o-ring. Heat from soldering or solvent cements may damage the nut, split ring or o-ring. Solder joints should be cool and solvent cements should be set before installing the nut, split ring and o-ring. Avoid getting primer and solvent cement on any part of the orings, split rings, bypass valve or control valve. Solvent cements and primers should be used in accordance with the manufacturer's instructions.

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Do not use pipe dope or other sealant on threads. Use teflon tape on threaded inlet, outlet and drain fittings. Teflon tape is not necessary on the nut connection or caps because of o-ring seals.

## INITIAL START-UP

*For detailed programming and operating information, please refer to the control valve section of this manual.*

1. Check all piping connections and make sure feed valves are open. Inspect plumbing for leaks.
2. Check that control valve is connected to electrical source.
3. Open Raw Water source valve.



**Note:** Check for leaks throughout system as pressure is applied.

4. Initiate manual regeneration of the control valve to regenerate: press "REGEN" button for three seconds.
5. Ensure drain line flow remains steady for 10 minutes or until clear. Step through the different regeneration cycles by pressing ▲ or ▼.
6. Observe regeneration effluent and continue to regenerate until discharge is clear. Steps 4 and 5 may need to be repeated as necessary.
7. Observe that valve advances through the different regeneration cycles and ends in service. Step through the different regeneration cycles by pressing ▲ or ▼.
8. Review control valve operations section of this manual and ensure settings are properly programmed before placing the carbon filter in service.

## SYSTEM MONITORING AND RECORD KEEPING

Monitor carbon filter daily and record all pertinent data. This data is needed to determine operating efficiency and for performing system maintenance. *The latter includes changing of the resin, pressure drop across the carbon filter tank and control valve.*

**Note:** Warranty Claims cannot be processed without adequate operating data and system history.

## **OPERATING CONDITIONS**

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For optimum carbon filter performance, observe the following:

- Maintain a minimum of 25 psi during backwash cycle.
- Water pressure should not exceed 120 psi across carbon tank.
- Water temperature should not exceed 110 °F.



**CAUTION:** *Hydrocarbons such as kerosene, benzene, gasoline, etc., may damage products that contain o-rings or plastic components. Exposure to such hydrocarbons may cause the products to leak. Do not use the product(s) contained in this document on water supplies that contain hydrocarbons such as kerosene, benzene, gasoline, etc.*

## **OPERATING DO'S AND DON'TS**

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### **DO:**

- Monitor system and keep a daily log.
- Maintain proper water pressure for backwashing.

### **DON'T:**

- Permit oils or fats in feed water.
- Shut down system for extended periods.
- Exceed operating pressures or temperatures.
- Backwash filter with insufficient water flow.



## MAINTENANCE

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### REMOVAL & REPLACEMENT OF CARBON MEDIA

#### Tools Needed:

- Wrench (to removing piping)
  - Screwdriver wide blade
  - Buckets (for materials)
  - Wet and Dry Vacuum Cleaner or Tarp
1. Turn off water to filter.
  2. Relieve pressure in tank by either opening a downstream valve or cycling the control valve into the back wash position.
  3. If a by-pass valve is installed, place it in the by-pass position.
  4. Disconnect drain line.
  5. Turn off electrical source and disconnect control valve. Remove any wiring connected to control valve.
  6. Loosen plumbing from control valve.
  7. Carefully move Carbon filter forward until it clears plumbing.
  8. Move Carbon filter to an area where access is available to all sides.
  9. Carefully loosen control valve on mineral tank top. Slowly unscrew valve being careful not to damage threads in top of tank.
  10. When valve is loose from top of tank, slowly twist it back and forth to remove it from top of distributor tube inside tank.
  11. To remove Carbon filter from mineral tank choose one of the recommended methods below:
    - a. **Vacuum Removal:** Vacuum all material out of tank and then wash inside with clean water.
    - b. **Manual Removal:** Place a canvas on floor to catch filter and other materials dumped from mineral tank. Lay tank on its side and tip it up to dump carbon filter and other materials out of tank. Slowly rotate tank as it is being dumped. When all material is out of tank wash it with clean water.

|   |
|---|
| <b>Note:</b> <i>Dispose of the Carbon &amp; Underbedding by local procedures or laws.</i> |
|---|

12. Replace media as per media loading instructions.
13. Perform start-up procedure.

## **CONTROL VALVE OPERATION & SERVICE**

# **CV1 CONTROL VALVES WITH METERED REGENERATION**



### **CONTROL VALVE SPECIFICATIONS**

- |   |   |
|---|---|
| • Minimum/Maximum Operating Pressures:    | 20 psi (138 kPa, 1.4 bar) to 125 psi (862 kPa, 8.6 bar) |
| • Minimum/Maximum Operating Temperatures: | 40°F (4°C) to 110°F (43°C)                              |

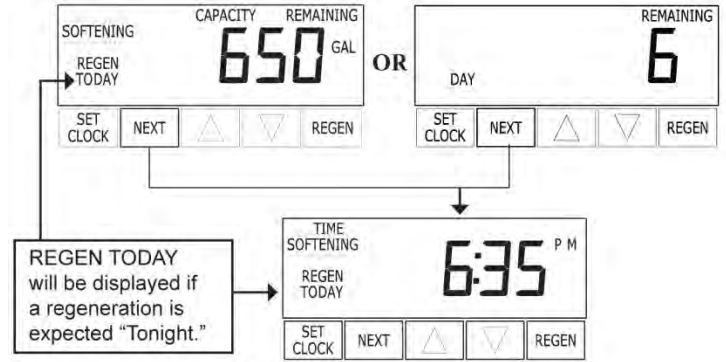
▲ No user serviceable parts are on the PC board, the motor, or the power adapter. The means of disconnection from the main power supply is by unplugging the power adapter from the wall.

## VALVE OPERATION QUICK REFERENCE GUIDE

### GENERAL OPERATION

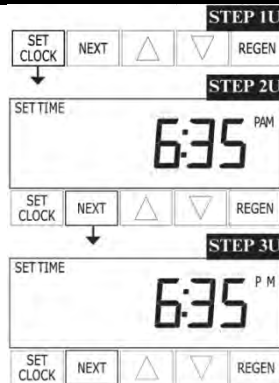
When the system is operating one of two displays will be shown. Pressing NEXT will alternate between the displays. One of the displays is the current time of day. The second display is one of the following: days remaining or gallons remaining.

If the system has called for a regeneration that will occur “tonight”, the words REGEN TODAY will appear on the display. When water is flowing through the system the word “FILTERING” flashes on the display.



### SET TIME OF DAY

In the event of a prolonged power outage, time of day flashes, indicating that it needs to be reset. All other information will be stored in memory no matter how long the power outage. Please complete the steps as shown to the right.



4. **Step 1U:** Press SET CLOCK
5. **Step 2U:** Current Time (hour): Set the hour of the day using ▲ or ▼ buttons. AM/PM toggles after 12. Press NEXT to go to step 3&U
6. **Step 3U:** Current Time (minutes): Set the minutes of the day using ▲ or ▼ buttons. Press NEXT to exit Set Clock. Press REGEN to return to previous step.

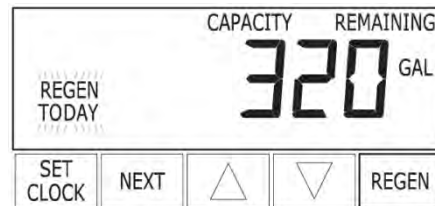
### MANUAL REGENERATION

**To initiate a generation at the preset delayed regeneration time of day:** Press and release “REGEN”. The words “REGEN TODAY” will flash on the display. If the “REGEN” button was pressed in error, pressing again will cancel the request.

**To initiate manual regeneration immediately:** Press and hold “REGEN” button for three seconds. System will begin regeneration immediately. Request cannot be cancelled.

The control valve may be stepped through the various regeneration cycles by pressing the “REGEN” button.

“REGEN TODAY” will flash if a regeneration is expected “Tonight”.



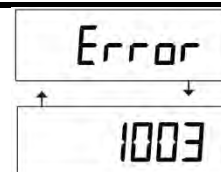
### REGENERATION MODE

When the carbon filter begins to regenerate, the display will change to include information about the step of the regeneration process and the time remaining for that step to be completed. The system runs through the steps automatically and will reset itself to provide treated water when the regeneration has been completed.



### ERROR MESSAGE

If the word “ERROR” and a number are alternately flashing on the display, check the trouble shooting section of this manual to identify the error.



## **GENERAL WARNINGS**

⚠ The control valve, fittings and/or bypass are designed to accommodate minor plumbing misalignments but are not designed to support the weight of a system or the plumbing.

⚠ Do not use Vaseline, oils, other hydrocarbon lubricants or spray silicone anywhere. A silicone lubricant may be used on black o-rings but is not necessary

⚠ The nuts and caps are designed to be unscrewed or tightened by hand or with the special plastic wrench. If necessary pliers can be used to unscrew the nut or cap. Do not use a pipe wrench to tighten or loosen nuts or caps. Do not place a screwdriver in the slots on caps and/or tap with a hammer.

⚠ The nuts and caps are designed to be unscrewed or tightened by hand or with the special plastic wrench. If necessary a pliers can be used to unscrew the nut or cap. Do not use a pipe wrench to tighten or loosen nuts or caps. Do not place a screwdriver in the slots on caps and/or tap with a hammer.

⚠ After completing any valve maintenance involving the drive assembly or the drive cap assembly and pistons unplug power source jack from the printed circuit board (black wire) and plug back in or press and hold SET and DOWN buttons for 3 seconds. The cover button may have other names like "SET HOUR", "CLOCK" or "SET CLOCK" but the circuit board is labeled with SET.

This resets the electronics and establishes the service piston position. The display should flash all wording, then flash the software version and then reset the valve to the service position.

⚠ Do not use pipe dope or other sealants on threads. Use Teflon tape on the threaded inlet, outlet and drain fittings. Teflon tape is not necessary on the nut connection or caps because of o-ring seals.

⚠ All plumbing should be done in accordance with local plumbing codes. The pipe size for the drain line should be a minimum of ½". Backwash flow rates in excess of 7 gpm (26.5 lpm) or length in excess of 20' (6.1m) require ¾" drain line.

⚠ Solder joints near the drain must be done prior to connecting the drain line flow control fitting. Leave at least 6" between the drain line control fitting and solder joints when soldering pipes that are connected on the drain line control fitting. Failure to do this could cause interior damage to the drain line flow control fitting.

⚠ When assembling the installation fitting package (inlet and outlet), connect the fitting to the plumbing system first and then attach the nut, split ring and o-ring. Heat from soldering or solvent cements may damage the nut, split ring or o-ring. Solder joints should be cool and solvent cements should be set before installing the nut, split ring and o-ring. Avoid getting primer and solvent cement on any part of the o-rings, split rings, bypass valve or control valve.

⚠ Plug into an electrical outlet. Note: All electrical connections must be connected according to local codes. (Be certain the outlet is uninterrupted.) Install grounding strap on metal pipes.

## **CONTROL VALVE GENERAL FEATURES AND INFORMATION**

This fully automatic control valve is designed as the primary control center to direct and regulate all cycles of an automatic backwashing filter. The control valve included with this system is equipped with a meter and can be set to regenerate on demand (consumption of a predetermined amount of water) and/or as a time clock\* (passage of a particular number of days).

The control valve regulates the flow rates for backwash and rinse cycles.

The control valve uses no traditional fasteners (e.g. screws); instead clips, threaded caps and nuts and snap type latches are used. Caps and nuts only need to be firmly hand tightened because radial seals are used. Tools required to service the valve include one small blade screw driver, one large blade screw driver, pliers and a pair of hands. A plastic wrench is available which eliminates the need for screwdrivers and pliers. Disassembly for servicing takes much less time than comparable products currently on the market. Control valve installation is made easy because the distributor tube can be cut ½" above to ½" below the top of tank thread. The distributor tube is held in place by an o-ring seal and the control valve also has a bayonet lock feature for upper distributor baskets.

The AC adapter comes with a 15 foot power cord and is designed for use with the control valve. The AC adapter is for dry location use only. The control valve maintains timekeeping for up to 8 hours if the power goes out and the battery is not depleted. After 8 hours, the only item that needs to be reset is the time of day; valve status and programming are permanently stored in the nonvolatile memory. If a power loss lasts less than 8 hours and the time flashes on and off, the time of day should be reset and the non-rechargeable battery should be replaced.

## **PROGRAMMING CONTROL VALVE OPTIONS**

The control valve offers multiple procedures that allow the valve to be modified to suit the needs of the installation. These procedures are:

- Filter Setup
- Installer Displays & Settings
- User Displays
- Diagnostics
- Valve History

These procedures can be accessed in any order. Details on each of the procedures are provided below and on the following pages.

At the discretion of the installer, the end user can access all settings. To “lock out” access to diagnostic and valve history displays and modifications to settings except hardness, day override, time of regeneration and time of day by anyone but the installer, press ▼, NEXT, ▲, and SET CLOCK in sequence after settings are made. To “unlock”, so other displays can be viewed and changes can be made, press ▼, NEXT, ▲, and SET CLOCK in sequence.

When in operation, normal user displays show the time of day or days remaining before regeneration. When stepping through a procedure, if no buttons are pressed within five minutes the display returns to a normal user display. Any changes made prior to the five minute time out are incorporated. The one exception is current flow rate display under the diagnostic procedure. The current flow rate display has a 30 minute time out feature.

To quickly exit Filter Setup, Display Settings, Diagnostics or Valve History press SET CLOCK. Any changes made prior to the exit are incorporated.

When desired all information in Diagnostics may be reset to zero when the valve is moved to a new location. To reset to zero, press NEXT and ▼ buttons simultaneously to go to the Service/Setup 1 screen, and release. Press ▲ and ▼ simultaneously to reset diagnostic values to zero. Screen will return to User Display.

## **REGENERATION CYCLE PROGRAMS**

Table 3 shows the possible orders of the cycles for a downflow water filter. When the control valve is used on a carbon filter, the program provides to option to specify one backwash or two backwashes. If two backwashes are specified, two rinses occur.

| <b>Table 3 – Regeneration Cycle Order<br/>for Downflow Water Filters</b> |                  |
|--|------------------|
| 1 <sup>st</sup> Cycle:   | Backwash         |
| 2 <sup>nd</sup> Cycle:   | Rinse            |
| 3 <sup>rd</sup> Cycle:   | Second Backwash* |
| 4 <sup>th</sup> Cycle:   | Second Rinse*    |
| 5 <sup>th</sup> Cycle:   | Service          |

*\*Second backwash is optional. Second rinse only occurs if second backwash option is selected.*

Backwashes can be set to **NORMAL** or to **LONGER**. The option selected will apply to both backwashes. Table 1 shows the length of the cycles.

▲ AMI Carbon Filters are programmed for **NORMAL** Length **SINGLE** Backwash as default. This should work for most applications. If **LONGER** or **DOUBLE** Backwash options are required, please see OEM programming section for setup instructions.

**Table 4 – Cycle Times in Minutes for Normal and Longer Backwash Lengths**

| Backwash Length Setting → |                          | SINGLE Backwash Cycle Times |        | DOUBLE Backwash Cycle Times |        |
|---------------------------|--------------------------|-----------------------------|--------|-----------------------------|--------|
|                           |                          | Normal (default)            | Longer | Normal                      | Longer |
| Cycle time in Minutes     | Backwash                 | 14                          | 16     | 8                           | 12     |
|                           | Rinse                    | 8                           | 10     | 6                           | 6      |
|                           | 2 <sup>nd</sup> Backwash | n/a                         | n/a    | 10                          | 12     |
|                           | 2 <sup>nd</sup> Rinse    | n/a                         | n/a    | 8                           | 10     |
|                           | Total                    | 22                          | 26     | 32                          | 40     |

## DEMAND INITIATED REGENERATION & TIME CLOCK OPTIONS

The control valve can be set for Demand Initiated Regeneration (DIR) only, Time Clock operation only or DIR and Time Clock whichever comes first, depending upon what settings are selected for Day Override and Gallon Capacity.<sup>1</sup> See Table 3.

<sup>1</sup> See the Installer Display Settings, Step 3I, Filter System Setup Step 6S for explanations of Day Override and Gallon Capacity.

⚠ AMI Metered Carbon Filters are programmed for **manual gallons capacity with a 12-Day Override** as default. This should work for most applications. If different regeneration settings are required, please see OEM programming section for setup instructions.

**Table 5 – DIR (Demand Initiated Regeneration) & Time Clock Options**

| DIR        | Time Clock | Settings <sup>4</sup>            |                   |
|------------|------------|----------------------------------|-------------------|
|            |            | Days Override                    | Gallon Capacity   |
| Yes        |            | OFF                              | Any Number        |
| <b>Yes</b> | <b>Yes</b> | <b>Any Number (Default = 12)</b> | <b>Any Number</b> |
|            | Yes        | Any Number                       | OFF               |

Default →

For DIR Filters, set the Gallons Capacity to a specific number. Automatic reserve capacity feature is available for water softeners only. If a reserve capacity is desired, set the gallon capacity to a value that is lower than the estimated capacity.

The control valve can also be set to regenerate immediately or at the next regeneration time by changing the Regeneration Time Option. There are three choices for settings:

1. **"NORMAL"** (sometimes referred to as "meter delayed") means when the gallons capacity reaches zero, it will stay in service until the next preset regeneration time, at which time regeneration will begin.
2. **"on 0"** means regeneration will occur immediately when the gallons capacity reaches zero.
3. **"NORMAL"** and **"on 0"** means the regeneration will occur at the preset regeneration time unless the gallons capacity reaches zero. If the gallons capacity reaches zero the regeneration will begin 10 minutes after no water usage.

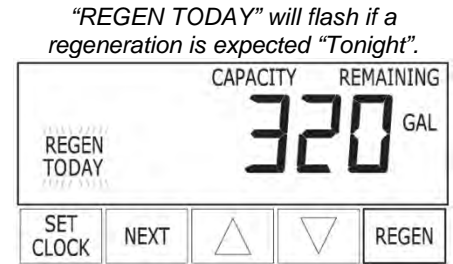
⚠ AMI Carbon Filters are programmed to **NORMAL** (meter delay) regeneration option. This should work for most applications. If different regeneration settings are required, please see OEM programming section for setup instructions.



## **MANUAL REGENERATION (BACKWASH)**

Manual regeneration can be performed at any time.

- **To schedule a regeneration to occur at the next delayed regeneration time of day:** Press and release the REGEN button. "Regen Today" will flash on the display and the regeneration will occur at the preset delayed regeneration time. The regeneration can be cancelled by pressing and releasing the REGEN button. This method of manually initiating regeneration is not allowed when the system is set to "on 0" (meter immediate), because there is no preset meter delay time.
- **To begin an immediate regeneration:** Press and hold the REGEN button for approximately 3 seconds. The regeneration will begin immediately. This cannot be cancelled, except by resetting the control by pressing NEXT and REGEN buttons simultaneously for 3 seconds.



The control valve may be stepped through the various regeneration cycles by pressing the "REGEN" button.

Sometimes it is desirable to have the valve initiate and complete two regenerations within 24 hours and then return to the preset regeneration procedure. It is possible to do a double regeneration if the control valve is set to "NORMAL" or "NORMAL + on 0". To enact a double regeneration:

1. Press the "REGEN" button once. REGEN TODAY will flash on the display.
2. Press and hold the "REGEN" button for three seconds until the valve regeneration initiates.

Once the valve has completed the immediate regeneration, the valve will regenerate one more time at the preset regeneration time.

## **ADDITIONAL CONTROL VALVE FUNCTIONS**

### **Water Usage Monitoring**

The metered control valve will display actual water usage for the last 63 days. The values are initially stored as "----". This means the value is unknown. As days pass values are stored as "0" for no flow or the actual number of gallons. The counting of the gallons starts at the regeneration time. If no regeneration time can be set (i.e. when the valve is set for immediate regeneration) the counting of gallons starts at 12 a.m. Day 1 is yesterday, day 2 the day before yesterday, etc. As new values are added the oldest history disappears.

### **Power Loss**

Only the current time of day will need to be reset if power is lost for greater than 8 hours. If power is lost while the system is regenerating, the control will complete regeneration at the point of interruption once power is restored.

## FILTER SYSTEM SETUP

Note: The Filter Valve will come pre-programmed with the default settings indicated in table 6. The below reference is for reprogramming in the case of a valve reset, or if a different setting is desired.

|   |  |
|---|--|
| <p><b>STEP 1F</b></p> <p>SET CLOCK NEXT   REGEN</p> <p>↓</p>  | <p><b>STEP 1F</b></p> <p>Press NEXT and ▼ buttons simultaneously for 3 seconds. If screen in step 2F does not appear in 5 seconds the lock on the valve is activated. To unlock press ▼, NEXT, ▲, and SET CLOCK in sequence, then press NEXT and ▼ simultaneously for 3 seconds.</p>   |
| <p><b>STEP 2F</b></p> <p>SET<br/>FILTERING</p> <p>SET CLOCK NEXT   REGEN</p> <p>↓</p>   | <p><b>STEP 2F</b></p> <p>Choose “FILTERING” using ▼ or ▲ buttons.<br/>Press NEXT to go to Step 3F. Press REGEN to exit OEM Filter System Setup.</p>  |
| <p><b>STEP 3F</b></p> <p>SET<br/>0.8 GAL<br/>FILL</p> <p>SET CLOCK NEXT   REGEN</p> <p>↓</p>  | <p><b>STEP 3F</b></p> <p>Enter “oFF” (to turn off regenerant refill) using ▼ or ▲ buttons.<br/>Press NEXT to go to Step 4F. Press REGEN to return to previous step.</p>  |
| <p><b>STEP 4F</b></p> <p>SET<br/>2<br/>NORMAL BACKWASH</p> <p>SET CLOCK NEXT   REGEN</p> <p>↓</p>                                       | <p><b>STEP 4F</b></p> <p>Backwash mode – Select using ▼ or ▲ buttons.<br/>(See table 4 for backwash cycle times)</p> <ul style="list-style-type: none"> <li>• “NORMAL” for SINGLE NORMAL backwash ← Default/Recommended</li> <li>• “NORMAL 2” for DOUBLE NORMAL length backwash</li> <li>• “LONGER” for SINGLE LONGER length backwash</li> <li>• “LONGER 2” for DOUBLE LONGER length backwash</li> </ul> <p>Press NEXT to go to Step 5F. Press REGEN to return to previous step.</p>   |
| <p><b>STEP 5F</b></p> <p>SET<br/>100 GAL<br/>REGEN</p> <p>SET CLOCK NEXT   REGEN</p> <p>↓</p>   | <p><b>STEP 5F</b></p> <p>Set Gallons Capacity using ▼ or ▲ buttons.</p> <ul style="list-style-type: none"> <li>• “oFF” = regeneration based on day override (time clock operation); or:</li> <li>• Number of gallons (20 to 50,100) for demand initiated regeneration.</li> </ul> <p>Press NEXT to go to Step 6F. Press REGEN to return to previous step.</p>  |
| <p><b>STEP 6F</b></p> <p>SET<br/>P05F<br/>FILL</p> <p>SET CLOCK NEXT   REGEN</p> <p>↓</p>   | <p><b>STEP 6F –Refill Option: Skipped, because “OFF” is selected in in step 3F</b></p> <p>Press NEXT to go to Step 7F. Press REGEN to return to previous step.</p>   |
| <p><b>STEP 7F</b></p> <p>SET TIME<br/>REGEN on 0<br/>NORMAL</p> <p>SET CLOCK NEXT   REGEN</p> <p>↓</p> <p>RETURN TO<br/>NORMAL MODE</p> | <p><b>STEP 7F</b></p> <p>Set Regeneration Time Option using ▼ or ▲ buttons:</p> <ul style="list-style-type: none"> <li>• “NORMAL” means regeneration will occur at the next preset time when the gallons capacity reaches zero.</li> <li>• “on 0” means regeneration will occur immediately when the gallons capacity reaches zero</li> <li>• “NORMAL + on 0” means regeneration will occur after 10 minutes of no water usage after the gallon capacity reaches zero.</li> </ul> <p>Press NEXT to exit Filter System Setup. Press REGEN to return to previous step.</p> |

Table 6 – Settings Options Table

→  
Recommended  
(Default) Setting  
→

| Volume Capacity | Regeneration Time Option | Days Override | Result   |
|-----------------|--------------------------|---------------|--|
| Any Number      | NORMAL                   | OFF           | Regeneration occurs at the next Regen Set Time when volume capacity reaches 0.<br>(Also known as <i>Meter Delay Demand Initiated Regeneration</i> )  |
| OFF             | NORMAL                   | Any Number    | Regeneration occurs at the next Regen Set Time when the specified number of days between regenerations is reached.<br>(Also known as <i>Time Clock Initiated Regeneration</i> )  |
| Any Number      | NORMAL                   | Any Number    | Regeneration occurs at the next Regen Set Time when volume capacity reaches 0 or the specified number of days between regenerations is reached.<br>( <i>Meter Delay Demand Initiated Regeneration with Days Override</i> )   |
| Any Number      | On 0                     | OFF           | Regeneration occurs immediately when volume capacity reaches 0. Time of regeneration will not be allowed to be set because regeneration will always occur immediately when volume capacity reaches 0.<br>(Also known as <i>Meter Immediate Demand Initiated Regeneration</i> ) |
| Any Number      | NORMAL + On 0            | Any Number    | Regeneration occurs at the next Regen Set Time when the specified number of days between regenerations is reached, unless the gallons capacity reaches 0 before that time. If the gallons capacity reaches 0, regeneration occurs after 10 minutes of no water usage.          |

Note: Reserve Capacity is not automatically estimated in Filtering applications. (Feature is available for softener applications only.) To set a manual reserve capacity, set the gallons capacity to a number that is lower than the actual estimated capacity of the system.

## INSTALLER DISPLAY SETTINGS

**STEP 1I**  
Press NEXT and ▲ simultaneously for 3 seconds to enter Installer Settings Screen.

**STEP 2I**  
This display should show “-nA-”  
Press NEXT to go to step 3I. Press REGEN to exit Installer Display Settings.

*(If Hardness Grains appear as shown on the left, the valve is incorrectly set up as a Softener: return to step 2F and refer to Filter System Setup instructions to correct.)*

**STEP 3I**  
Day Override: When gallon capacity is set to AUTO or to a number, Day Override sets the maximum number of days between regenerations. **Recommended Setting for Days Override = 12 Days.** If value set to “OFF” regeneration initiation is based solely on gallons used. If value is set as a number (allowable range from 1 to 28) a regeneration initiation will be called for on that day even if sufficient number of gallons were not used to call for a regeneration. Set Day Override using ▼ or ▲ buttons:

- number of days between regeneration (1 to 28); or
- “OFF”.

*When gallon capacity is set to off, the valve operates as a time clock valve and the Day Override sets the number of days between regenerations.*  
See Setting Options Table for more detail on setup.  
Press NEXT to go to step 4I. Press REGEN to return to previous step.

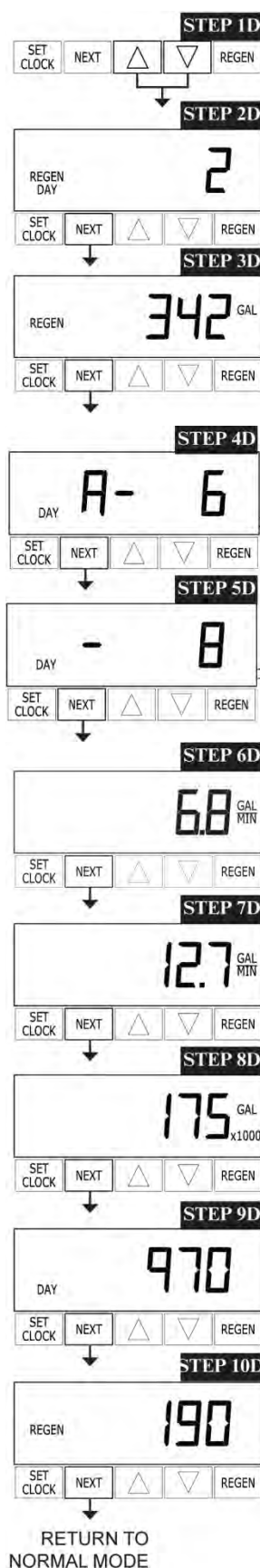
**STEP 4I**  
Next Regeneration Time\* (hour): Set the hour of day for regeneration using ▼ or ▲ buttons. AM/PM toggles after 12. The default time is 2:00 a.m. This display will show “REGEN on 0 GAL” if “on 0” is selected in Step 7F.  
Press NEXT to go to step 5I. Press REGEN to return to previous step.

**STEP 5I**  
Next Regeneration Time\* (minutes): Set the minutes of day for regeneration using ▼ or ▲ buttons. This display will not be shown if “on 0” is selected in Step 7F. Press NEXT to exit Installer Display Settings. Press REGEN to return to previous step.

\* Typically a system is set to regenerate at a time of low water usage. An example of a time with low water usage is when a household is asleep. If there is a demand for water when the system is regenerating, untreated water will be used.

## DIAGNOSTICS

For all steps below: Press the **NEXT** button to proceed to the next step. Press **REGEN** to return to previous step or exit.



### STEP 1D

Press ▼ or ▲ simultaneously for three seconds. If screen in step 2D does not appear in 5 seconds the lock on the valve is activated. To unlock press ▼, NEXT, ▲, and SET CLOCK in sequence, then press NEXT and ▼ simultaneously for 3 seconds.

### STEP 2D

Days, since last regeneration: This display shows the days since the last regeneration occurred.

### STEP 3D

Gallons, since last regeneration: This display shows the number of gallons that have been treated since the last regeneration.

### STEP 4D

Gallons used each day for last 7 days Pressing the ▲ Button will show day 1 (which would be yesterday) and flashes the gallons used. Pressing the ▲ button again will show day 2 (the day before yesterday) and the gallons used. Keep pressing the ▲ button to show the gallons for days 3, 4, 5 and 6. The ▼ button can be pressed to move backwards in the day series.

### STEP 5D

Gallons, 63 day usage history: This display shows day 1 (for yesterday) and flashes the number of gallons treated yesterday. Pressing the ▲ button will show day 2 (which would be the day before yesterday) and flashes the number of gallons treated on that day. Continue to press the ▲ button to show the maximum number of gallons treated for the last 63 days. This display will show dashes if a water meter is not installed.

### STEP 6D

Flow rate, current: Turn the water on at one or more taps in the building. The flow rate in gallons per minute will be displayed. If flow stops the value will fall to zero in a few seconds.

### STEP 7D

Flow rate, maximum last seven days: The maximum flow rate in gallons per minute that occurred in the last seven days will be displayed.

### STEP 8D

Gallons, total used since last reset: The total number of gallons used since last reset will be displayed.

### STEP 9D

Days, total number since last reset: The total number of days the control valve has been in service since last reset will be displayed.

### STEP 10D

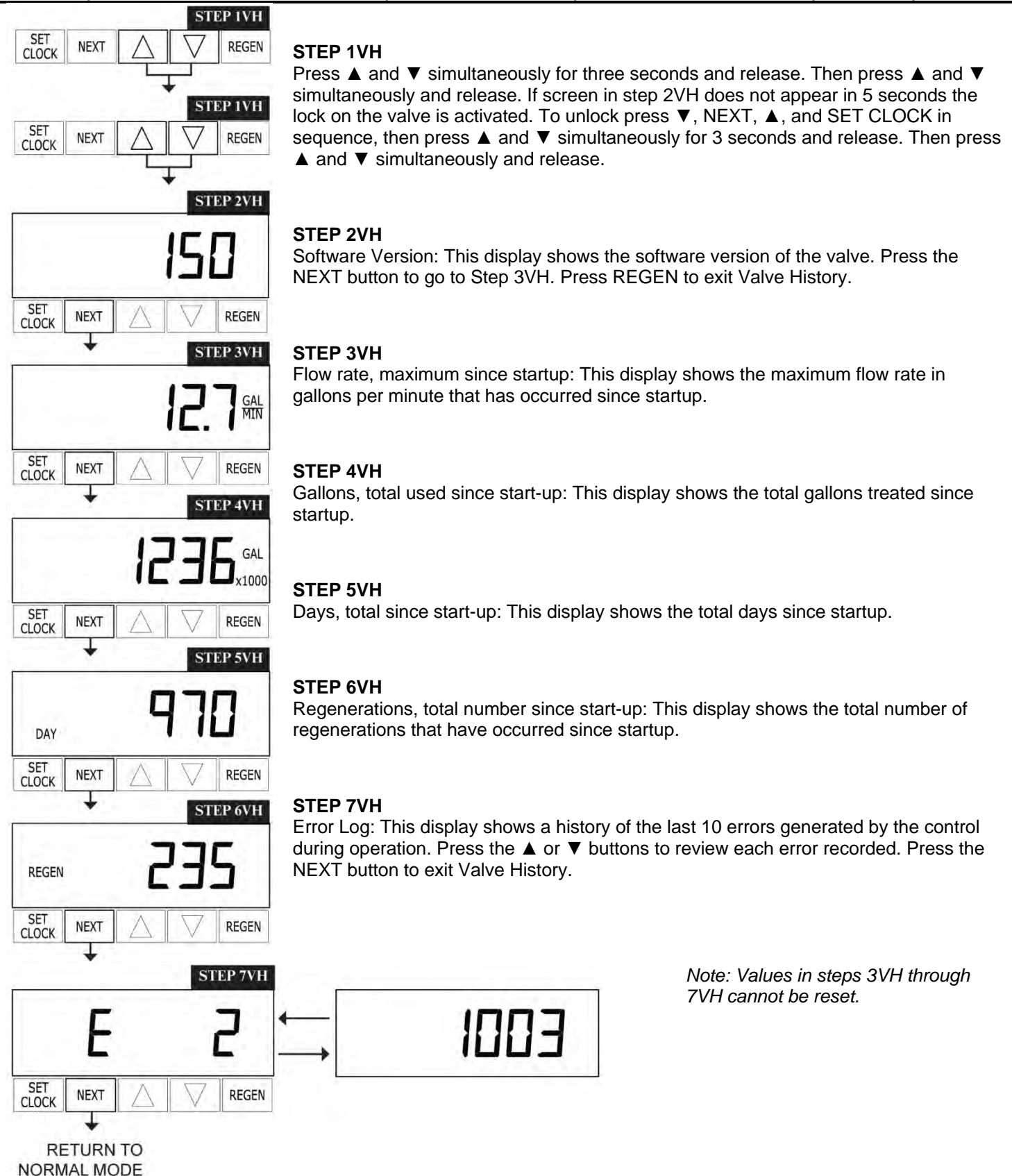
Regenerations, total number since last reset: The total number of regenerations that have occurred since last reset will be displayed.

**When desired, all information in Diagnostics may be reset to zero. To reset to zero, press NEXT and ▼ buttons simultaneously to go to the Service screen, and release. Press ▼ and ▲ simultaneously to reset diagnostic values to zero. Screen will return to user display.**



## VALVE HISTORY

For all steps below: Press the **NEXT** button to proceed to the next step. Press **REGEN** to return to previous step or exit.



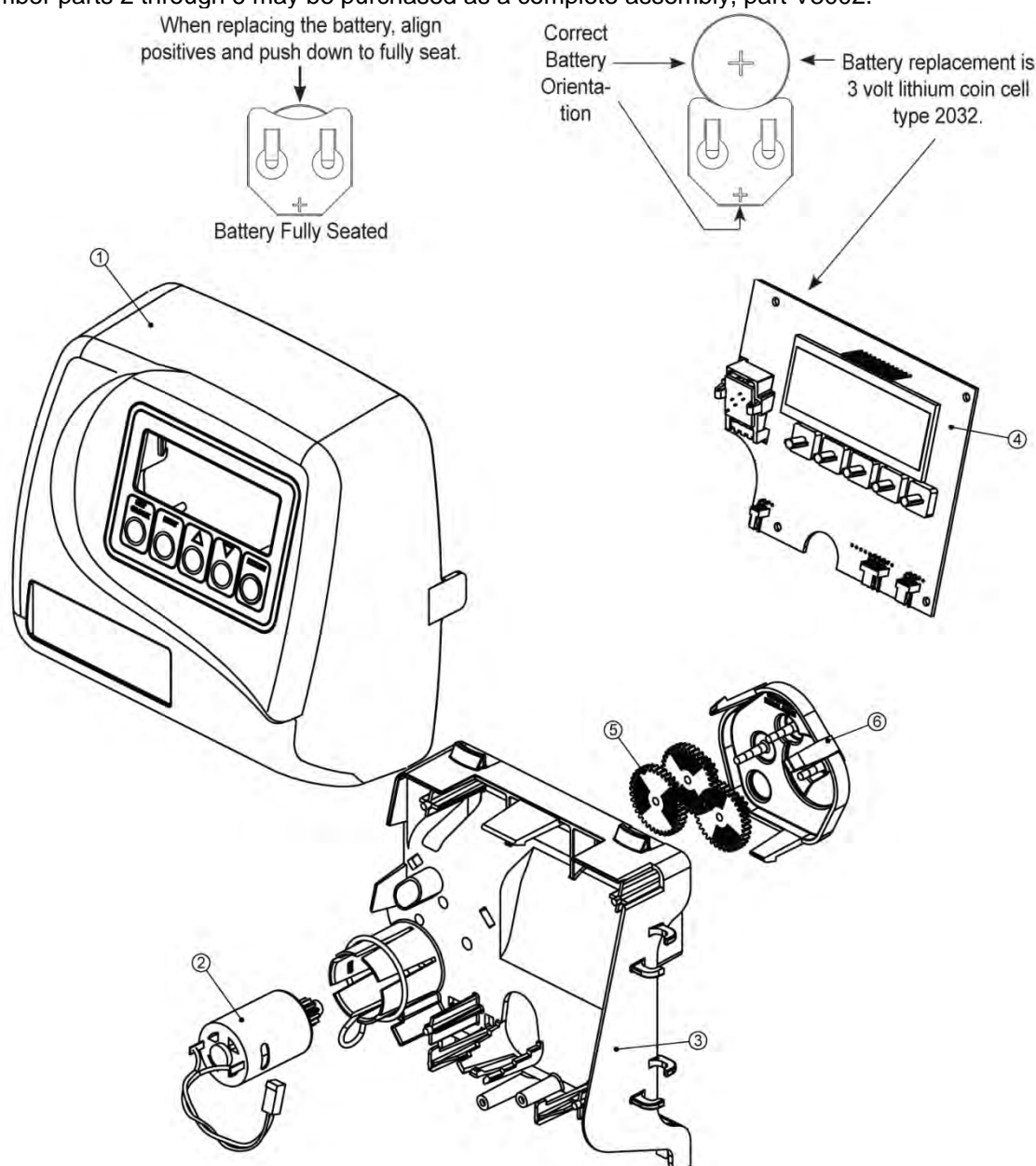


## CONTROL VALVE DRAWINGS AND COMPONENTS

### FRONT COVER & DRIVE ASSEMBLY

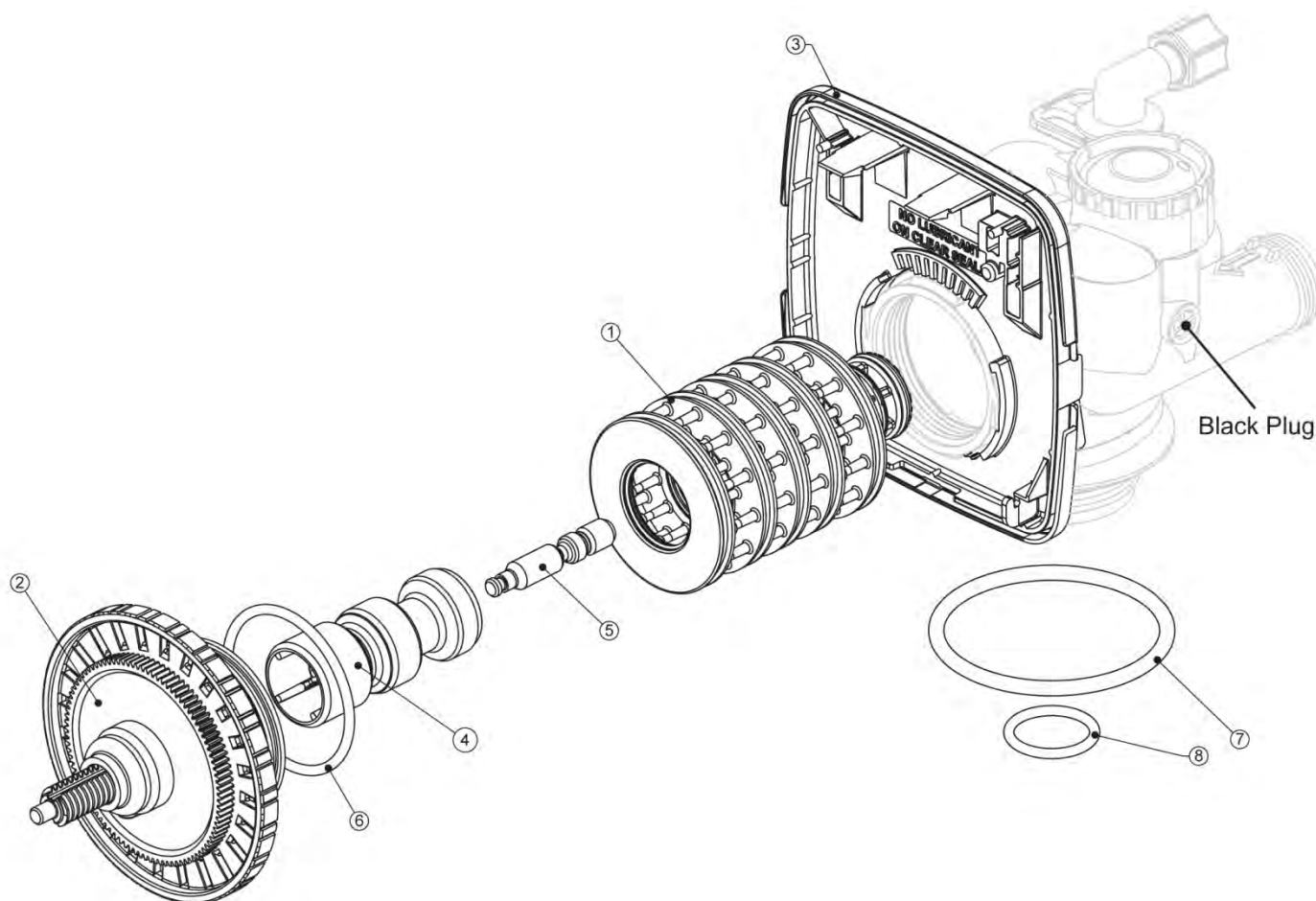
| Dwg. No.  | Item No.      | Description                        | Qty. Per Valve |
|-----------|---------------|------------------------------------|----------------|
| 1         | V3715-01      | CV1 Front Cover Assembly           | 1              |
| 2         | V3107-01      | CV1 Motor Assembly                 | 1              |
| 3         | V3106-01      | CV1 Drive Bracket & Spring Clip    | 1              |
| 4         | V3108-09BOARD | CV1 PC Board with Battery REPLACE  | 1              |
| 5         | V3110         | CV1 Drive Reducing Gear 12x36      | 3              |
| 6         | V3109         | CV1 Drive Gear Cover               | 1              |
| *         | V3002         | CV1 Drive Assembly                 | *              |
| Not Shown | V3186         | CV1 AC Adapter 120v – 12v, USA     | 1              |
|           | V3186EU       | CV1 AC Adapter 220v-240v – 12v, EU |                |
|           | V3186UK       | CV1 AC Adapter 220v-240v – 12v, UK |                |
|           | V3186-01      | CV1 AC Adapter Cord Only           |                |

\*Drawing number parts 2 through 6 may be purchased as a complete assembly, part V3002.



**DRIVE CAP ASSEMBLY, DOWNFLOW PISTON,  
REGENERATE PISTON & SPACER STACK ASSEMBLY**

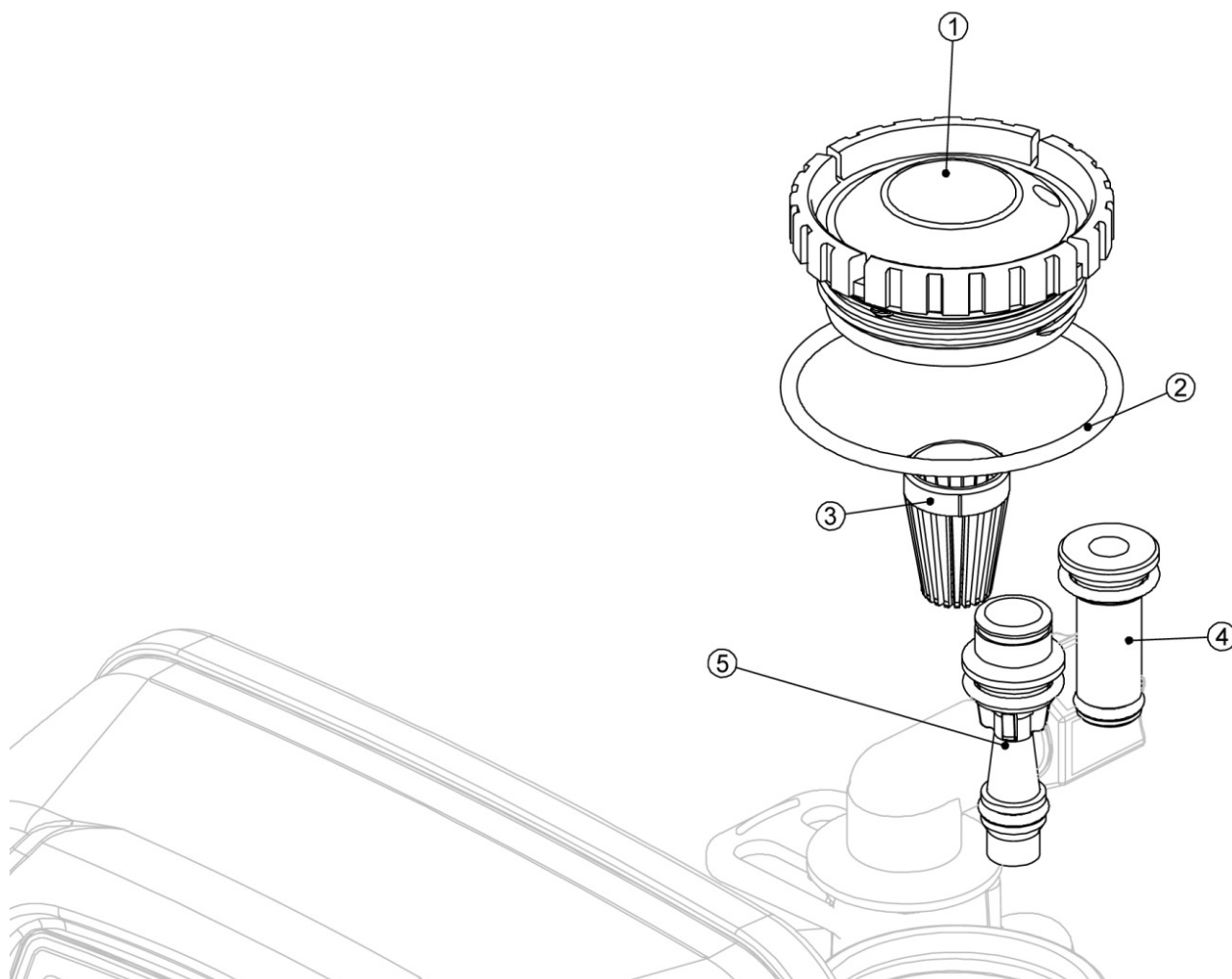
| Dwg. No.     | Item No. | Description                    | Qty. Per Valve |
|--------------|----------|--------------------------------|----------------|
| 1            | V3005    | CV1 Spacer Stack Assembly      | 1              |
| 2            | V3004    | Drive Cap Assembly             | 1              |
| 3            | V3178    | CV1 Drive Back Plate           | 1              |
| 4            | V3011    | CV1Piston Downflow Assembly    | 1              |
| 5            | V3174    | CV1Regenerant Piston           | 1              |
| 6            | V3135    | O-Ring 228                     | 1              |
| 7            | V3180    | O-Ring 337                     | 1              |
| 8            | V3105    | O-Ring 215 (Distributor Type)  | 1              |
| Not<br>Shown | V3001    | CV1 Body Assembly, Downflow    | 1              |
|              | V3001-02 | CV1 Mixing Valve Body Assembly |                |



## **INJECTOR CAP, INJECTOR SCREEN, INJECTOR, PLUG AND O-RING**

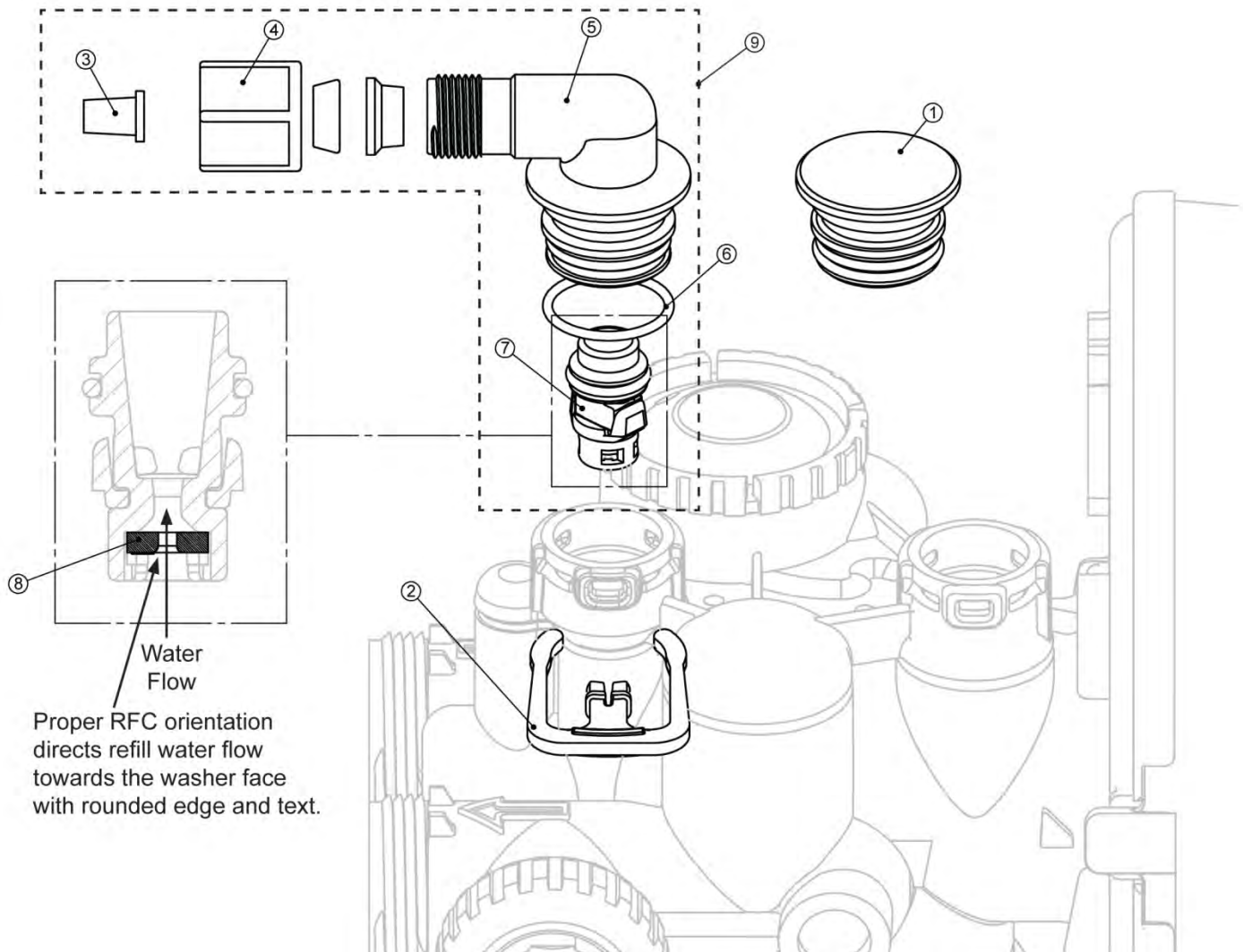
| Dwg. No.  | Item No. | Description                  | Qty. Per Valve |
|-----------|----------|------------------------------|----------------|
| 1         | V3176    | Injector Cap                 | 1              |
| 2         | V3152    | O-Ring 315                   | 1              |
| 3         | V3177-01 | Injector Screen Cage         | 1              |
| 4         | V3010-1Z | CV1 Injector Assembly Z Plug | 1              |
| Not Shown | V3170    | O-Ring 011                   | *              |
|           | V3171    | O-Ring 013                   | *              |

\* The injector plug and the injector each contain one 011 (lower) and 013 (upper) o-ring. For a filter that only backwashes, injector plugs are located in both holes.



## **REFILL FLOW CONTROL ASSEMBLY AND REFILL PORT PLUG**

| Dwg. No. | Item No.   | Description                                  | Qty. Per Valve |
|----------|------------|--|----------------|
| 1        | V3195-01   | CV1 Refill Port Plug Assembly                | 1              |
| 2        | H4615      | Elbow Locking Clip                           | 1              |
| 3        | JCP-P-6    | Polytube Insert $\frac{3}{8}$ "              | Softener Only  |
| 4        | JCPG-6PBLK | Nut $\frac{3}{8}$ "                          | Softener Only  |
| 5        | H4613      | Elbow Cap $\frac{3}{8}$ "                    | Softener Only  |
| 6        | V3163      | O-Ring 019                                   | Softener Only  |
| 7        | V3165-01*  | CV1 RFC Retainer Asy (0.5 gpm)               | Softener Only  |
| 8        | V3182      | CV1 RFC                                      | Softener Only  |
| 9        | V3330-01   | CV1 Brine Elbow Asy with RFC $\frac{3}{8}$ " | Softener Only  |

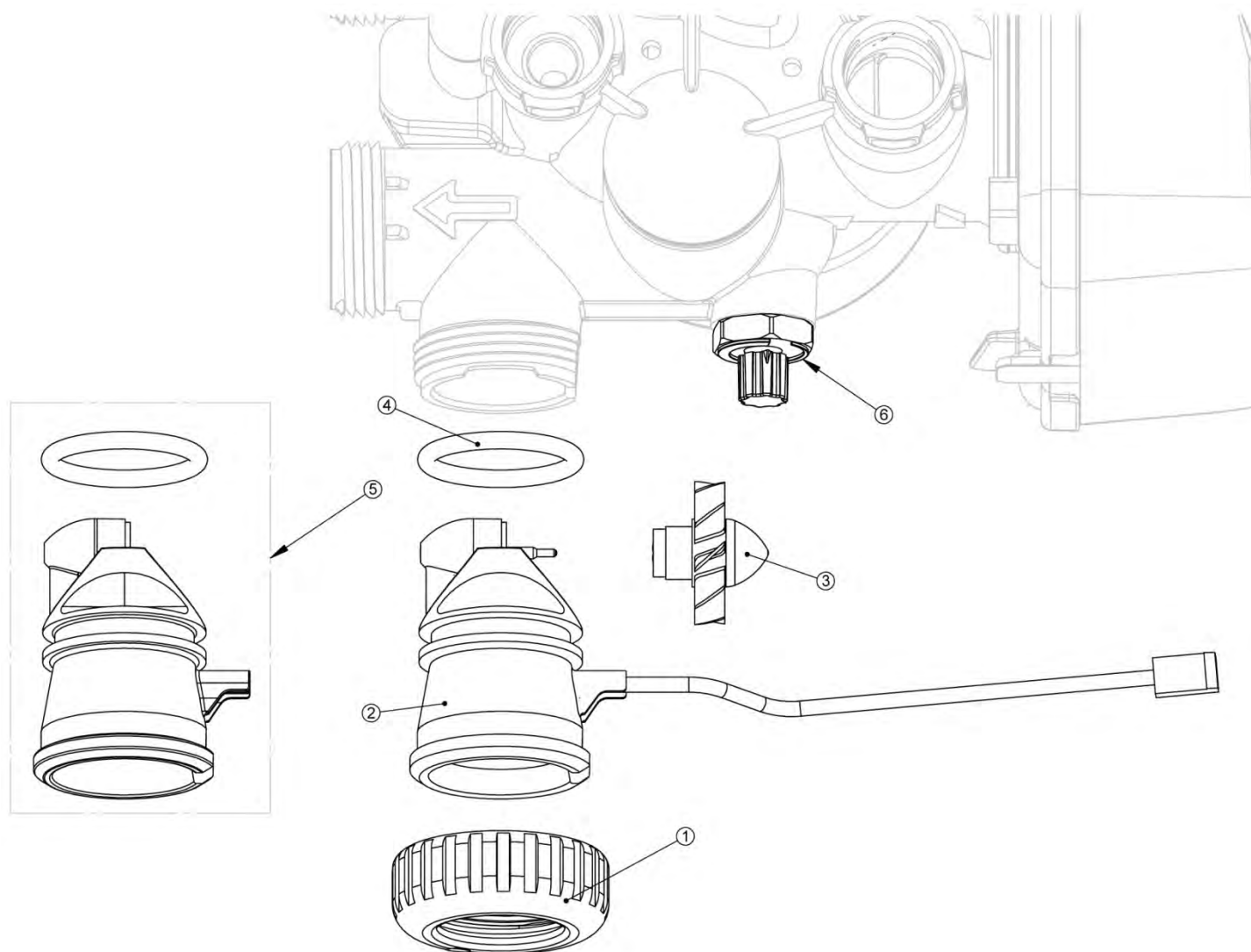




## **WATER METER, METER PLUG AND MIXING VALVE**

| Dwg. No. | Item No. | Description             | Qty. Per Valve |
|----------|----------|-------------------------|----------------|
| 1        | V3151    | CV1 Nut, 1", QC         | 1              |
| 2        | V3003*   | CV1 Meter Assembly      | 1              |
| 3        | V3118-01 | CV1 Turbine Assembly    | 1              |
| 4        | V3105    | O-Ring, 215             | 1              |
| 5        | V3003-01 | CV1 Meter Plug Assembly | 1              |
| 6        | V3013    | Mixing Valve            | Optional       |

\*Order number V3003 includes V3118-01 CV Turbine Assembly and V3105 O-Ring



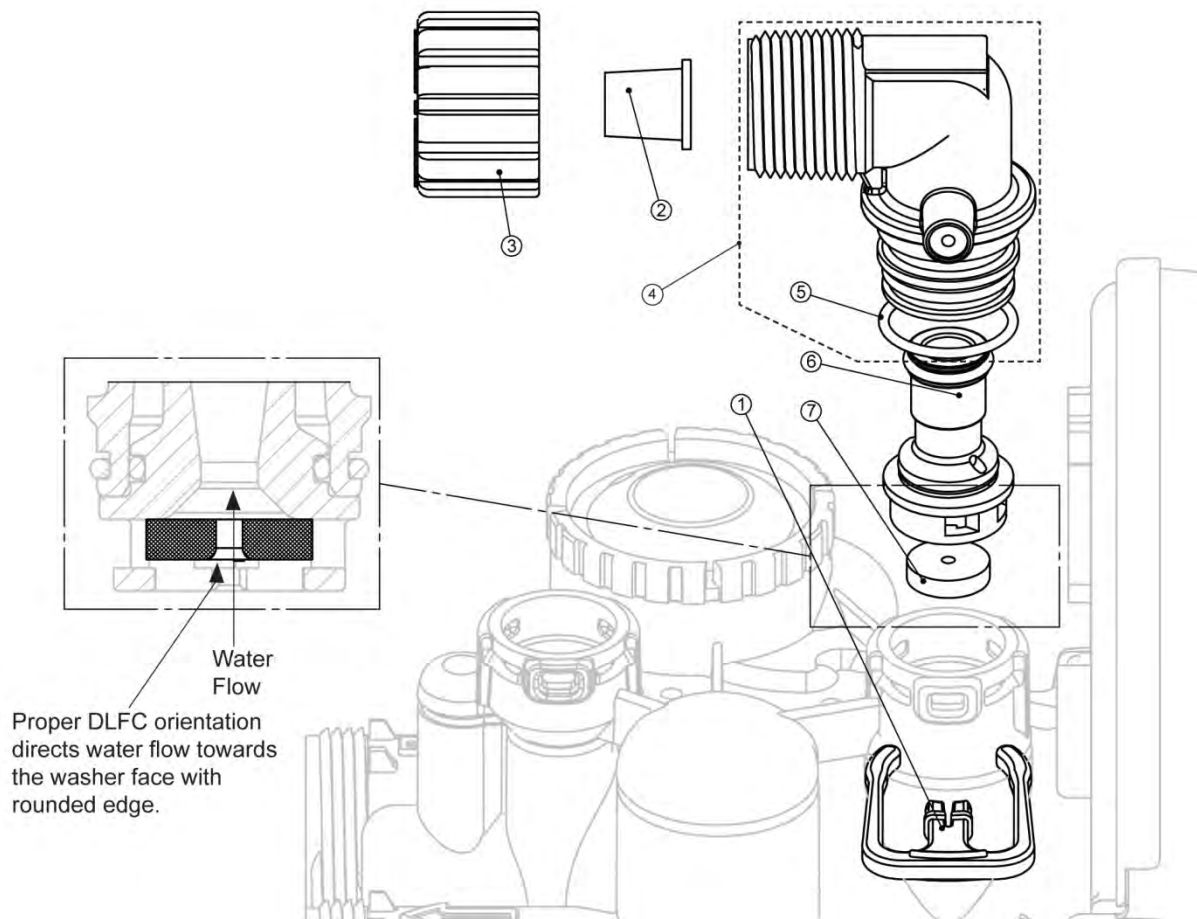
**⚠** This Water Meter should not be used as the primary monitoring device for critical or health effect applications.

## DRAIN LINE – 3/4" (7" TO 14" DIAMETER UNITS)

| Dwg. No. | Item No.      | Description               | Filter Used on       | Qty. Per Valve  |
|----------|---------------|---------------------------|----------------------|---|
| 1        | H4615         | Elbow Locking Clip        | ALL                  | 1   |
| 2        | PKP10TS8-BULK | Polytube insert 5/8"      | ALL                  | Option  |
| 3        | V3192         | CV1 Nut 3/4" Drain Elbow  | ALL                  | Option  |
| 4*       | V3158-01      | CV Drain Elbow 3/4" Male  | ALL                  | 1   |
| 5        | V3163         | O-Ring 019                | ALL                  | 1   |
| 6*       | V3159-01      | CV1 DLFC Retainer Asy     | ALL                  | 1   |
| 7        | V3162-022     | CV1 DLFC 2.2 gpm for 3/4" | W-G744EM             | (1)<br>of the model<br>indicated in the<br>column to the left |
|          | V3162-027     | CV1 DLFC 2.7 gpm for 3/4" | W-G844EM             |   |
|          | V3162-042     | CV1 DLFC 4.2 gpm for 3/4" | W-G940EM             |   |
|          | V3162-053     | CV1 DLFC 5.3 gpm for 3/4" | W-G1054EM            |   |
|          | V3162-065     | CV1 DLFC 6.5 gpm for 3/4" | W-G1252EM            |   |
|          | V3162-075     | CV1 DLFC 7.5 gpm for 3/4" | W-G1354EM, W-G1465EM |   |

\*4 and 6 can be ordered as a complete assembly – V3331 CV1 Drain Elbow Retainer Assembly

Replacement valves are shipped without drain line flow control, 3/4" nut and 5/8" polytube insert – order DLFC separately and install before using.

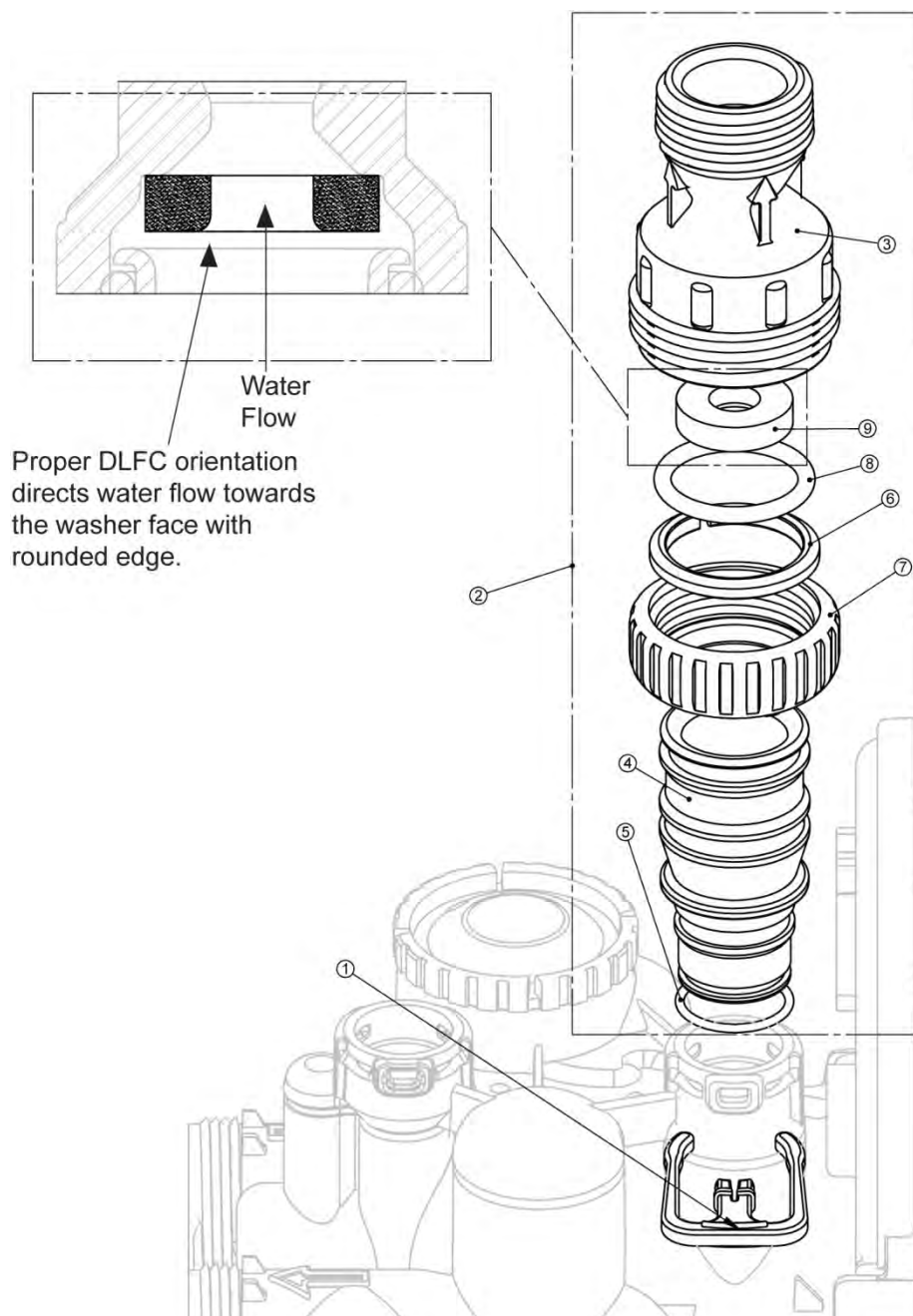




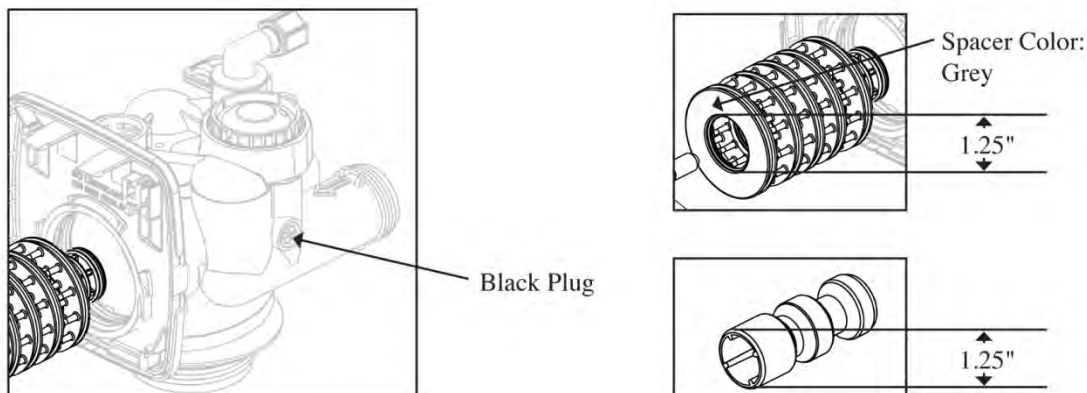
## DRAIN LINE – 1" (16" DIAMETER UNITS)

| Dwg. No. | Item No.  | Description                   | Filter Used on | Qty. Per Valve |
|----------|-----------|-------------------------------|----------------|----------------|
| 1        | H4615     | Elbow Locking Clip            | W-G1665EM      | 1              |
| 2        | V3008-02  | Drain Fitting, 1" Straight    | W-G1665EM      | 1              |
| 3*       | V3166     | Drain Fitting Body            | W-G1665EM      | 1              |
| 4*       | V3167     | Drain Fitting Adapter         | W-G1665EM      | 1              |
| 5*       | V3163     | O-Ring 019                    | W-G1665EM      | 1              |
| 6*       | V3150     | Split Ring                    | W-G1665EM      | 1              |
| 7*       | V3151     | Nut, 1" QC                    | W-G1665EM      | 1              |
| 8*       | V3108     | O-Ring 215                    | W-G1665EM      | 1              |
| 9        | V3190-150 | CV1 DLFC Washer 15 gpm for 1" | W-G1665EM      | 1              |

\*Can be ordered as a set. Order number V3008-02, description: WS1 drain Fitting 1" Straight.



## **DISTRIBUTOR TUBE OPENING IDENTIFICATION (1.050")**

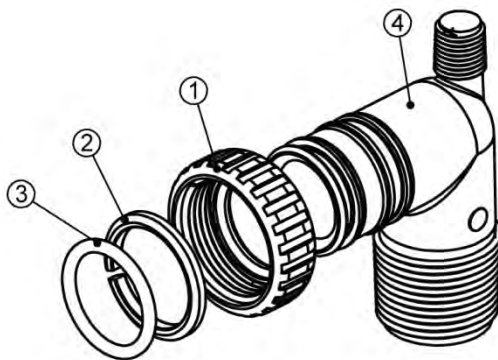


Note: The WS1 downflow piston is a solid amber color.

## **INSTALLATION FITTING ASSEMBLY**

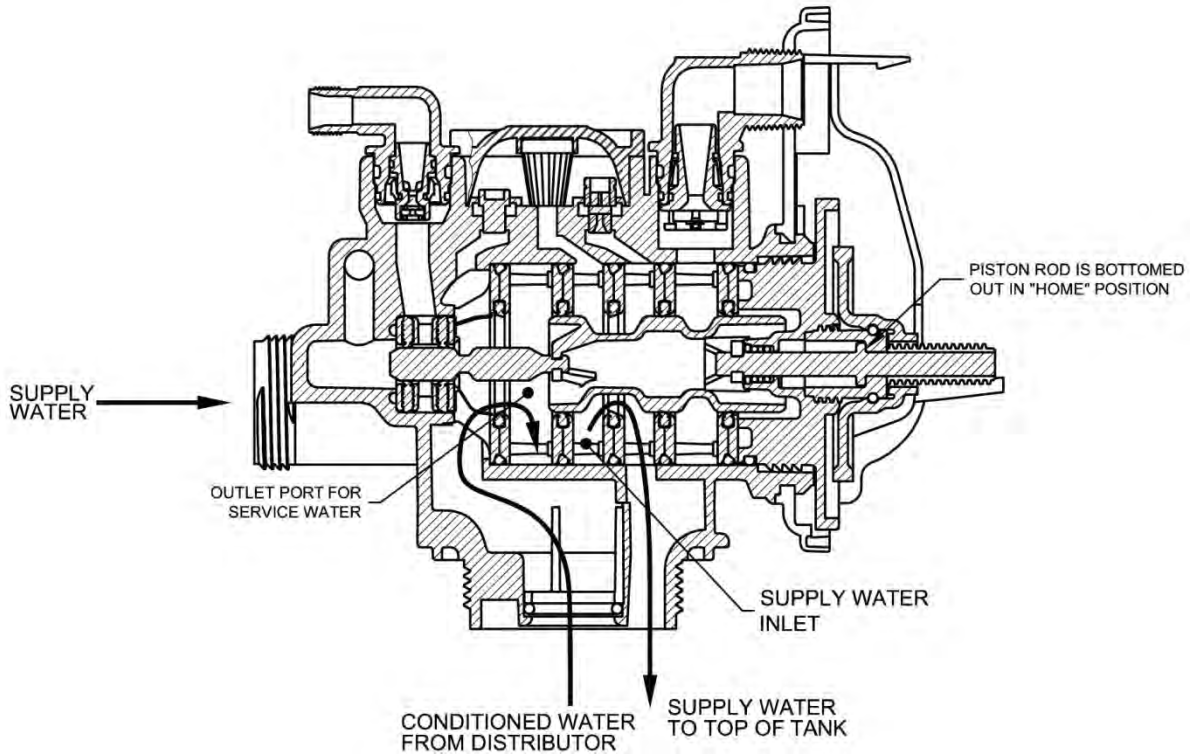
Assembly Model Number: V3007 – CV1 Fitting, 1" PVC Male NPT Elbow Assembly

| Dwg. No. | Item No. | Description                       | Qty. Per Assembly |
|----------|----------|-----------------------------------|-------------------|
| 1        | V3151    | CV1 Nut 1" Quick Connect          | 2                 |
| 2        | V3150    | CV1 Split Ring                    | 2                 |
| 3        | V3105    | O-Ring 215                        | 2                 |
| 4        | V3149    | CV1 Fitting 1" PVC Male NPT Elbow | 2                 |

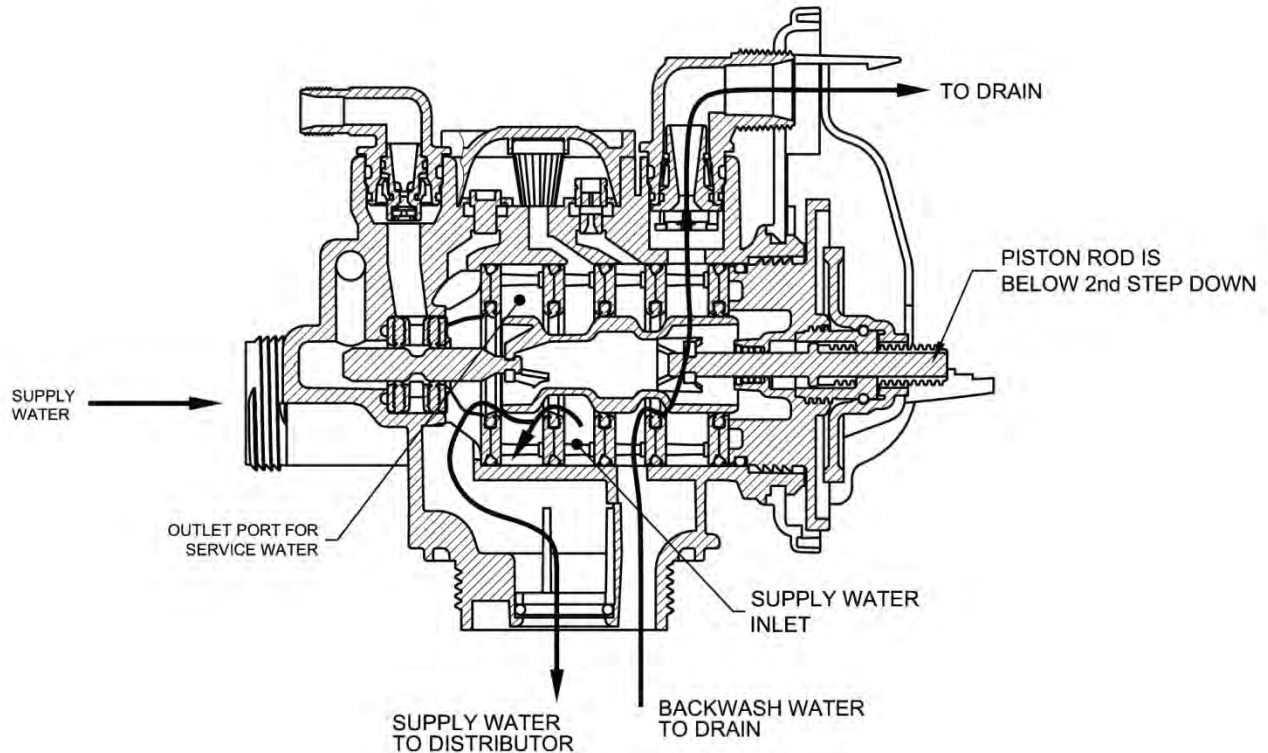


## FLOW DIAGRAMS

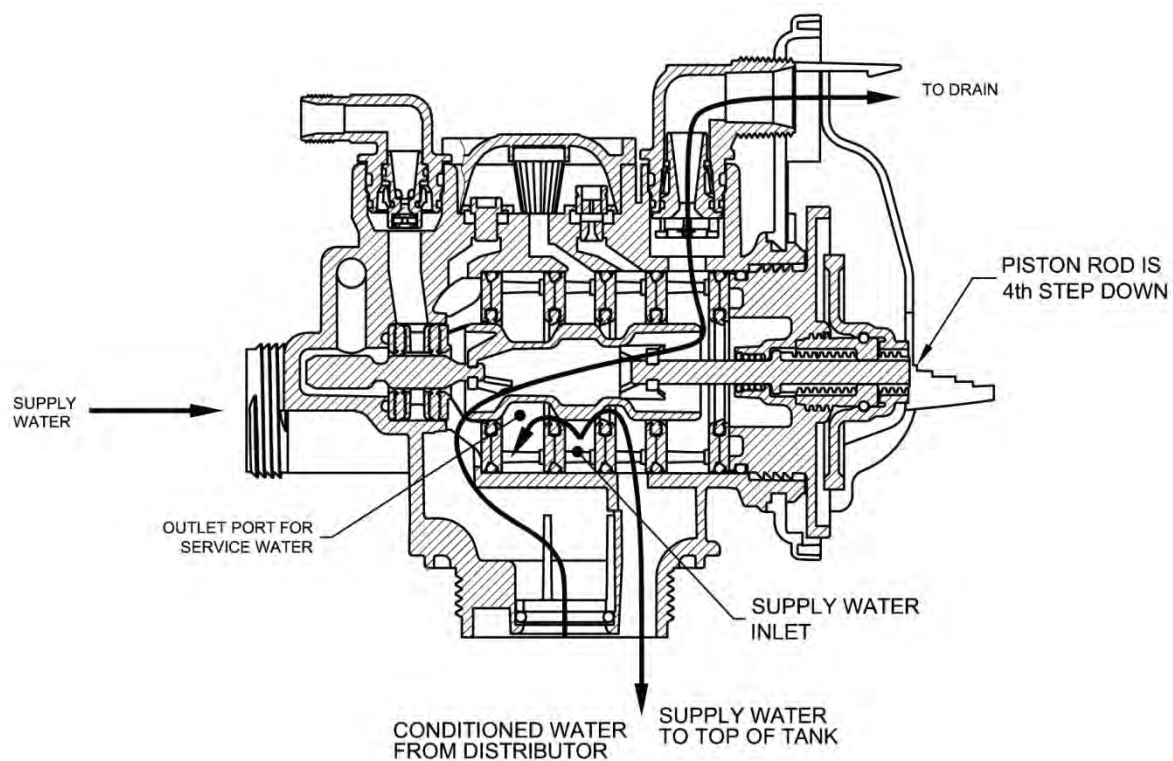
### Service Flow Diagram



### Backwash Flow Diagram



### **Rinse Flow Diagram**

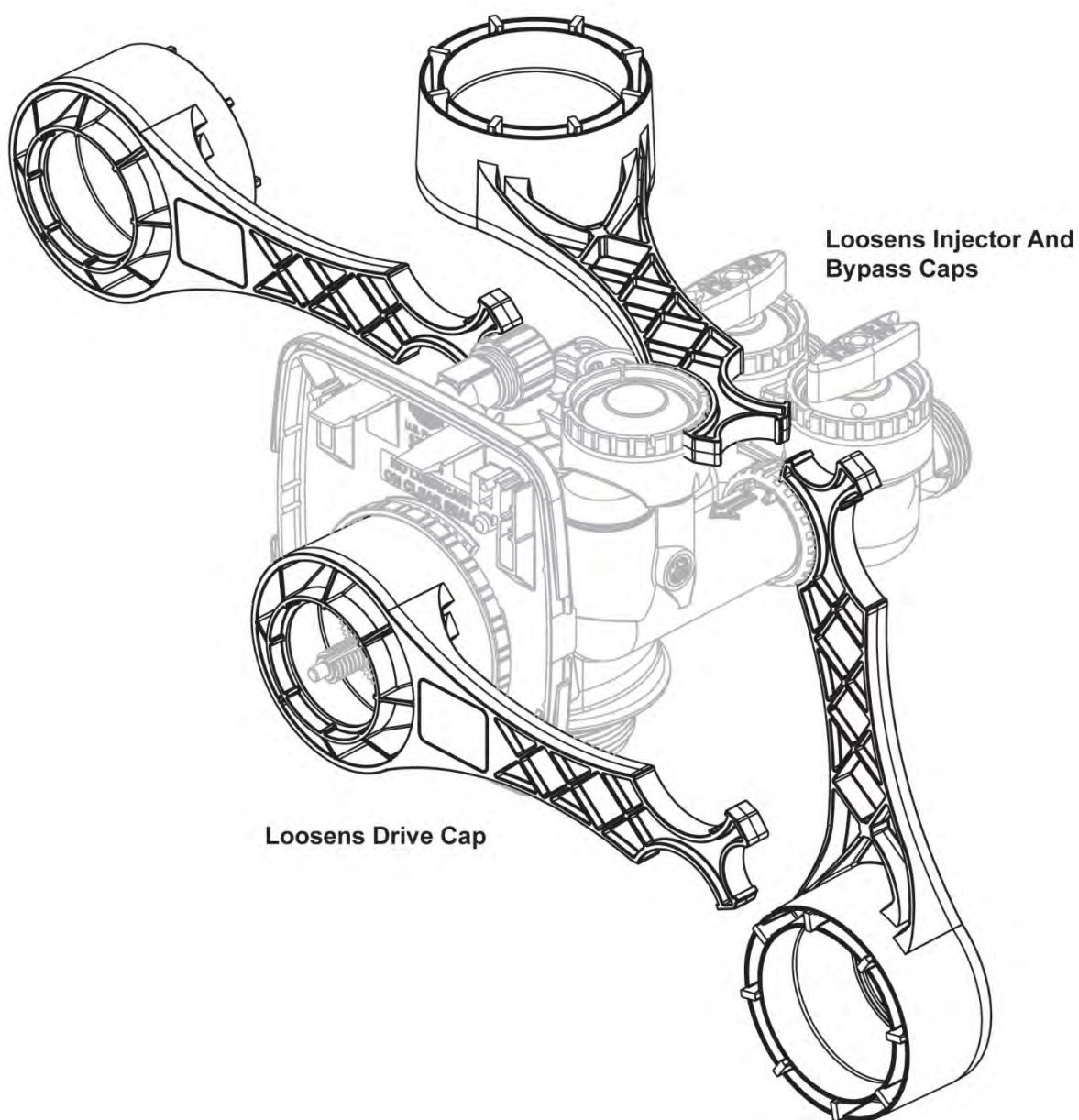




## **SERVICE SPANNER WRENCH**

**Model No: V3193-02**

Although no tools are necessary to assemble or disassemble the valve, the CV1 wrench (shown below in various positions on the valve) may be purchased separately to aid in assembly or disassembly of the control valve.



## **CONTROL VALVE COMPONENTS DESCRIPTION**

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The CV1 control valves consist of the following components:

1. Drive Assembly
2. Drive Cap Assembly, Main Piston and Regenerant Piston
3. Spacer Stack Assembly
4. Injector Cap, Screen, Injector Plug and Injector
5. Drain Line Flow Control
6. Installation Fitting Assemblies
7. Water Meter or Meter Plug

### **DRIVE ASSEMBLY**

The drive assembly consists of the following parts:

- Drive Bracket
- Printed Circuit (PC) Board
- Motor
- Drive Gears
- Drive Gear Cover

The drive bracket holds the PC board, the motor, the drive gears and the drive gear cover in place.

The PC board receives and retains information, displays the information, determines when to regenerate and initiates regeneration. The display shows different types of information in the initial system set up, installer display settings, diagnostics, valve history, or user display settings.

The PC board powers the motor. The PC board's two-prong jack connects wires to the direct current (DC) motor. The motor is held in place on the drive bracket by a spring-loaded clip and a small bulge in the plastic, which fits in one of the slots on the motor housing. The motor turns drive gears that drive the piston to cycle positions for backwashing, regeneration, rinsing, refill or service. The motor is fully reversible (turns both ways) and changes direction of rotation to change the direction of piston motion. The motor is easily replaced if necessary.

There are three drive gears held in place by the drive gear cover. All three drive gears are the same size. A reflective coating is applied to the gears. As the center drive gear turns a light shines on the coating and a light sensing diode determines if a light pulse was returned. The PC board counts the pulses and determines when to stop driving the motor.

### **DRIVE CAP ASSEMBLY, MAIN PISTON, REGENERANT PISTON**

The drive gears turn the main gear of the drive cap assembly, which moves the piston. The screw-driven, horizontally moving piston stops at specific positions to direct the flow of water to backwash, regenerate, rinse or refill. The PC board determines the position of the piston by counting pulses produced when the piston is moved. An optical sensor looking at one of the reduction drive gears generates these pulses. Each cycle position is defined by a number of pulses. The counter is zeroed each time the valve goes to the service position. The PC board finds the service position by noting the increase in current delivered to the motor when the mechanical stop at the service position is reached. This method of controlling piston position allows for greater flexibility and requires no switches or cams (U.S. Patent 6444127).

The valve included on your water softener includes a 1.25" diameter downflow piston. A regenerant piston is attached to the main piston.

### **SPACER STACK ASSEMBLY**

The spacer stack assembly provides the necessary flow passage for water during the different cycles. The all-plastic spacer stack assembly (U.S. Patent 6402944) is a one-piece design which allows the stack to be removed using your fingers.

The exterior of the stack is sealed against the body bore with self-lubricating EPDM o-rings, while the interior surface is sealed against the piston using slippery self-cleaning directional (one-way) silicone lip seals. The lip seals are clear in color and have a special slippery coating so that the piston does not need to be lubricated.



## **INJECTOR PLUG AND REFILL FLOW PLUG**

The screen, injector and/or injector plug(s) are installed under the injector cap in an easy to access location on top of the valve. The injector cap contains four slots so no water accumulates in the cap. The injector cap is designed to be hand tightened. The valves used for backwash filters have plugs (part # V3010-1Z) installed in both openings and refill plug (part # V3195-01) is present in place of the refill elbow.

## **DRAIN LINE FLOW CONTROL AND FITTING ASSEMBLY**

The drain line flow control assembly includes a drain line flow control and a fitting. The drain line flow control allows proper media bed expansion by regulating the flow rate to the drain. The drain line flow control is a flexible washer-like part with an orifice and a precision molded contour. The flow rates are within  $\pm 10\%$  over the pressure range of 20 psi to 125 psi (1.4 bar to 8.6 bar). See table for flow rate information.

| Model No.*       | Backwash Flow Rate |                   | Drain Line Fitting | Drain Line Flow Control Order No. | Number on Drain Line Flow Control |
|------------------|--------------------|-------------------|--------------------|-----------------------------------|-----------------------------------|
|                  | Gallons per minute | Liters per minute |                    |                                   |                                   |
| <b>W-G744EM</b>  | 2.2                | 8.3               | 3/4"               | V3162-022                         | 022                               |
| <b>W-G844EM</b>  | 2.7                | 10.2              | 3/4"               | V3162-027                         | 027                               |
| <b>W-G940EM</b>  | 3.2                | 12.1              | 3/4"               | V3162-032                         | 032                               |
| <b>W-G1054EM</b> | 4.2                | 15.9              | 3/4"               | V3162-042                         | 042                               |
| <b>W-G1252EM</b> | 6.5                | 24.6              | 3/4"               | V3162-065                         | 065                               |
| <b>W-G1354EM</b> | 7.5                | 28.4              | 3/4"               | V3162-075                         | 075                               |
| <b>W-G1465EM</b> | 7.5                | 28.4              | 3/4"               | V3162-075                         | 075                               |
| <b>W-G1665EM</b> | 15                 | 56.8              | 3/4"               | V3162-150                         | 150                               |


The drain line flow control and fitting are located on top of the control valve and replaceable without the use of special tools. The drain line flow control can be installed in the standard 3/4" drain line elbow, which accommodates 5/8" polytube or 3/4" NPT drain line connections. The optional nut and polytube insert for the 3/4" drain line elbow is designed for use with flexible polytube only. The 3/4" drain line elbow can be rotated 180 degrees so the outlet can be orientated to the nearest drain. The same retainer is used for all drain line flow controls for the 3/4" fitting. Drain line flow controls designed for the 3/4" fitting are available for flow rates ranging from 0.7 to 10 gpm (2.6 to 37.9 lpm).


## **INSTALLATION FITTING ASSEMBLIES**

Both elbow fittings have a unique drill out feature to allow a 1/4" NPT connection to the inlet and/or outlet which can be used for a RO feed, test ports, pressure tap ports, etc. The installation fitting assemblies are sold in pairs and consist of two fittings, two nuts, two split rings and two o-rings. The installation fitting assemblies and the bypass valve are sold separately from the control valve.

## **WATER METER OR METER PLUG**

The water meter is installed on the outlet side of the control valve. The water meter uses a turbine to measure gallons of treated water. The turbine rotates with the flow of water and reports its rate of rotation through Hall effect<sup>2</sup> circuitry to the printed circuit (PC) board. This rotation permits the PC board to record the total volume of treated water and the flow rate. The small centrally located magnet is shielded from water, which substantially reduces iron-fouling problems with the turbine.

 *This Water Meter should not be used as the primary monitoring device for critical or health effect applications.*

 *Operating Pressures: 20 psi minimum, 12 psi maximum; Operating Temperatures: 40°F Minimum, 110°F Maximum*

The turbine is accurate to within  $\pm 5\%$  over a wide operating flow rate range (0.25 gpm [0.95 lpm] up to control valve maximums) and has a very low pressure drop. Water used for regeneration is not metered. If the control valve is set to prefill the regenerant, water used between the prefill cycle up to the start of the regeneration cycle is metered. If the control valve is in regeneration mode and there is a water demand, that water usage is not metered.

When facing the front of the control valve, the water meter is positioned on the left-hand side of the control valve. Allow sufficient clearance to clean and repair the water meter without disconnecting the plumbing or disassembling any other parts of the control valve.

## **CONTROL VALVE SERVICE INSTRUCTIONS**

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### **DRIVE ASSEMBLY**

Remove the valve cover to access the drive assembly.

Disconnect the power source plug (black wire) from the PC board prior to disconnecting the motor or water meter plugs from the PC board. The power source plug connects to the four-pin jack. The motor plug connects to the two-pin jack on the left-hand side of the PC board. The water meter plug (gray wire) connects to the three-pin jack on the far right-hand side of the PC board.

The PC board can be removed separately from the drive bracket but it is not recommended. Do not attempt to remove the display panel from the PC board. Handle the board by the edges. To remove the PC board from the drive bracket, unplug the power, water meter and motor plugs from the PC board. Lift the middle latch along the top of the drive bracket while pulling outward on the top of the PC board. The drive bracket has two plastic pins that fit into the holes on the lower edge of the PC board. Once the PC board is tilted about 45° from the drive bracket it can be lifted off of these pins. To reinstall the PC board, position the lower edge of the PC board so that the holes in the PC board line up with the plastic pins. Push the top of the PC board towards the valve until it snaps under the middle latch, weave the power and water meter wires into the holders and reconnect the motor, water meter and power plugs.

The drive bracket must be removed to access the drive cap assembly and pistons or the drive gear cover. It is not necessary to remove the PC board from the drive bracket to remove the drive bracket. To remove the drive bracket start by removing the plugs for the power source and the water meter. Unweave the wires from the side holders. Two tabs on the top of the drive back plate hold the drive bracket in place. Simultaneously lift the two tabs and gently ease the top of the drive bracket forward. The lower edge of the drive bracket has two notches that rest on the drive back plate. Lift up and outward on the drive bracket to disengage the notches.

To reassemble, seat the bottom of the drive bracket so the notches are engaged at the bottom of the drive back plate. Push the top of the drive bracket toward the two latches. The drive bracket may have to be lifted slightly to let the threaded piston rod pass through the hole in the drive bracket. Maintain a slight engaging force on top of the drive bracket while deflecting the bracket slightly to the left by pressing on the side of the upper right corner. This helps the drive gears mesh with the drive cap assembly. The drive bracket is properly seated when it snaps under the latches on the drive back plate. If resistance is felt before latching, then notches are not fully engaged, the piston rod is not in hole, the wires are jammed between the drive bracket and drive back plate, or the gear is not engaging the drive cap assembly.

To inspect the drive gears, the drive gear cover needs to be removed. Before trying to remove the gear cover, the drive bracket must be removed from the drive back plate. (Refer to the instructions above regarding removing the drive bracket from the drive back plate. The drive gear cover can be removed from the drive bracket without removing the motor or the PC board.) The drive gear cover is held in place on the drive bracket by three clips. The largest of the three clips is always orientated to the bottom of the drive bracket. With the PC board facing up, push in and down on the large clip on the drive gear cover. Handle the cover and the gears carefully so that the gears do not fall off the pegs in the cover. Replace broken or damaged drive gears. Do not lubricate any of the gears. Avoid getting any foreign matter on the reflective coating because dirt or oils may interfere with pulse counting.

The drive gear cover only fits on one way, with the large clip orientated towards the bottom. If all three clips are outside of the gear shroud on the drive bracket the drive gear cover slips easily into place.

The drive bracket does not need to be removed from the drive plate if the motor needs to be removed. To remove the motor, disconnect the power and motor plugs from the jacks on the PC board. Move the spring clip loop to the right and hold. Rotate the motor at least a ¼ turn in either direction so the wires are vertical (up & down) before gently pulling on the wire connectors to remove the motor. Pulling directly on the wires without rotating the motor may break the wires off the motor.

Replace the motor if necessary. Do not lubricate the motor or the gears. To reinstall the motor, move the spring clip loop to the right and hold. Gently turn the motor while inserting so that the gear on the motor meshes with the gears under the drive gear cover. Release the spring clip loop and continue to rotate the motor until the wires are horizontal and the motor housing engages the small plastic bulge inside the drive bracket motor retainer. Reconnect the motor plug to the two-pronged jack on the lower left side of the PC board. If the motor will not easily engage with the drive gears when reinstalling, lift and slightly rotate the motor before reinserting. Reconnect the power plug.

Replace the valve cover. After completing any valve maintenance involving the drive assembly or the drive cap assembly and pistons unplug power source jack from the printed circuit board (black wire) and plug back in or press and hold SET and DOWN buttons for 3 seconds. (The cover button may have other names like “SET HOUR”, “CLOCK” or “SET CLOCK” but the circuit board is labeled with SET.) This resets the electronics and establishes the service piston position. The display should flash all wording, then flash the software version and then reset the valve to the service position.

### **DRIVE CAP ASSEMBLY, MAIN PISTON AND REGENERANT PISTON**

The drive assembly must be removed to access the drive cap assembly. The drive cap assembly must be removed to access the piston(s). The drive cap assembly is threaded into the control valve body and seals with an o-ring. To remove the drive cap assembly use the special plastic wrench or insert a ¼” to ½” flat blade screwdriver into one of the slots around the top 2” of the drive cap assembly so it engages the notches molded into the drive back plate around the top 2” of the piston cavity. See Figure 5. The notches are visible through the holes. Lever the screwdriver so the drive cap assembly turns counter clockwise. Once loosened unscrew the drive cap assembly by hand and pull straight out.

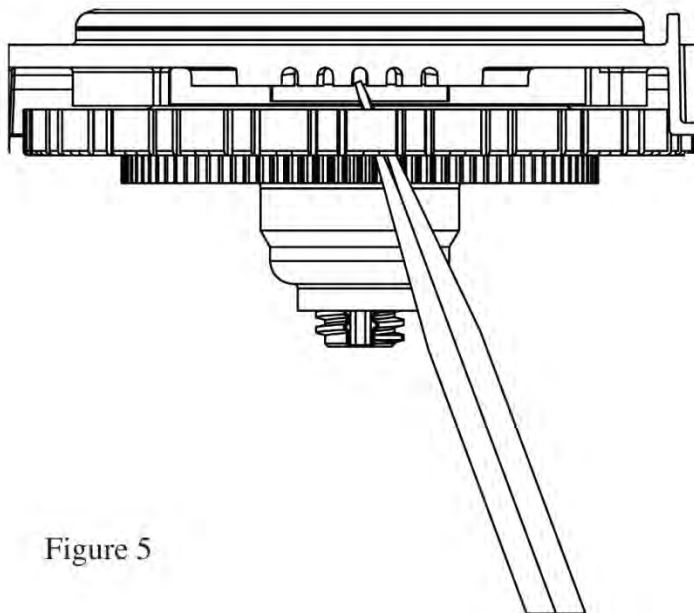


Figure 5

To remove the main piston fully extend the piston rod and then unsnap the main piston from its latch by pressing on the side with the number. Chemically clean in dilute sodium bisulfite or vinegar, or replace the main piston.

Reattach the main piston to the drive cap assembly. Reattach the regenerant piston (if needed) to the main piston. Reinsert the drive cap assembly and piston into the spacer stack assembly and hand tighten the drive cap assembly. Continue to tighten the drive cap assembly using a screwdriver as a ratchet until the black o-ring on the spacer stack assembly is no longer visible through the drain port. Excessive force can break the notches molded into the drive back plate. Make certain that the main drive gear still turns freely. The exact position of the piston is not important as long as the main drive gear turns freely.

Reattach the drive assembly to the control valve and connect all plugs. After completing any valve maintenance involving the drive assembly or the drive cap assembly and pistons unplug power source jack from the printed circuit board (black wire) and plug back in or press and hold SET and DOWN buttons for 3 seconds. (The cover button may have other names like “SET HOUR”, “CLOCK” or “SET CLOCK” but the circuit board is labeled with SET.) This resets the electronics and establishes the service piston position. The display should flash all wording, then flash the software version and then reset the valve to the service position.

## **SPACER STACK ASSEMBLY**

*For spacer stack identification refer to drawing in valve drawings section of this manual.*

To access the spacer stack assembly remove the drive assembly, drive cap assembly and piston. The spacer stack assembly can be removed easily without tools by using thumb and forefinger. Inspect the black o-rings and clear lip seals for wear or damage. Replace the entire stack if necessary. Do not disassemble the stack.


The spacer stack assembly may be chemically cleaned (dilute sodium bisulfite or vinegar) or wiped with a soft cloth. The spacer stack assembly can be pushed in to the control valve body bore by hand. Since the spacer stack assembly can be compressed it is easier to use a blunt object ( $\frac{5}{8}$ " to  $1\frac{1}{8}$ " in diameter) to push the center of the assembly into the control valve body. The assembly is properly seated when at least four threads are exposed (approximately  $\frac{5}{8}$ "). Do not force the spacer stack assembly in. The control valve body bore interior can be lubricated with silicone to allow for easy insertion of the entire stack.


Reattach the drive cap assembly and piston(s) and the drive assembly.

After completing any valve maintenance involving the drive assembly or the drive cap assembly and pistons unplug power source jack from the printed circuit board (black wire) and plug back in or press and hold SET and DOWN buttons for 3 seconds. (The cover button may have other names like "SET HOUR", "CLOCK" or "SET CLOCK" but the circuit board is labeled with SET.) This resets the electronics and establishes the service piston position. The display should flash all wording, then flash the software version and then reset the valve to the service position.

## **WATER METER**

The water meter assembly is connected to the PC board by a wire. If the entire water meter assembly is to be replaced, remove the control valve cover and disconnect the power source and water meter plugs from the PC board. Unlatch the drive assembly and lean it forward. Unthread the water meter wire from the side of the drive assembly and through the drive back plate. To reinstall, rethread the water meter wire through the drive back plate and the side of the drive assembly. Reattach the drive assembly and the water meter and power plugs.

 *This Water Meter should not be used as the primary monitoring device for critical or health effect applications.*

 *Operating Pressures: 20 psi minimum, 12 psi maximum; Operating Temperatures: 40°F Minimum, 110°F Maximum*

The water meter wire does not need to be removed from the PC board if the water meter is only being inspected and cleaned. To remove the water meter assembly, unscrew the meter cap on the left side of the control valve. Pliers may be used to unscrew the nut if necessary.

## **DRAIN LINE FLOW CONTROL**

To access the drain line flow control remove the locking clip by pulling it straight out. Pull fitting out and replace the locking clip so that it is not misplaced. The drain line fitting is pressed in and has an o-ring seal.

In the  $\frac{3}{4}$ " elbow, the white flow control retainer is pressed in and has an o-ring seal. The retainer can be removed by rotating and pulling. The flow control can be removed by prying upward with a small blade flat screwdriver in one of the slots on the side. The drain line flow control and retainer can be chemically cleaned in dilute sodium bisulfite or vinegar, or replaced. Do not use a wire brush to clean the flow control or the washer. The washers are identified with three numbers, which correspond to the flow rate. When reinstalling make sure the identifying number and the rounded inside diameter on the washer is visible when seated in the retainer. The white flow control washer retainer can also be removed and cleaned. Push the retainer in firmly when reinstalling.

## TROUBLESHOOTING

| PROBLEM  | POSSIBLE CAUSE   | SOLUTION  |
|--|--|---|
| Inlet pressure low                               | Low supply pressure  | Correct incoming supply pressure  |
|  | Low flow from source   | Remove blockage or other restrictions   |
| Treated water flow low                           | Media/Resin bed fouled   | Backwash Filter   |
|  | Valves closed  | Check valves and fully open   |
| Treated water has chlorine                       | Bypass valve is open or faulty   | Fully close bypass valve or replace   |
|  | Damaged seal/stack assembly  | Replace seal/stack assembly   |
|  | Control valve body type and piston type mismatched   | Verify proper control valve body type and piston type match   |
|  | Fouled media bed   | Replace media bed   |
| No Display on PC Board                           | No Power at electrical outlet  | Repair outlet or use working outlet   |
|  | Control Valve Power Adapter not plugged into outlet or power cord end not connected to PC board connection | Plug Power Adapter into outlet or connect power cord end to PC Board connection   |
|  | Improper Power Supply  | Verify power voltage is being delivered to the PC Board   |
|  | Defective Power Adapter  | Replace Power Adapter   |
|  | Defective PC Board   | Replace PC Board  |
| PC Board does not display correct time of day    | Power Adapter plugged into electric outlet controlled by light switch                                      | Use uninterrupted outlet  |
|  | Tripped breaker switch and/or tripped GFI  | Reset breaker switch and/ or GFI switch   |
|  | Power outage   | Reset time of day. If PC Board has battery backup present the battery may be depleted. See Front Cover and Drive Assembly drawing for instructions. |
|  | Defective PC Board   | Replace PC Board  |
| Display does not indicate that water is flowing. | Bypass valve in bypass position  | Turn bypass handles to place bypass in service position   |
|  | Meter is not connected to meter connection on PC Board   | Connect meter to three pin connection labeled METER on PC Board   |
|  | Restricted/ stalled meter turbine  | Remove meter and check for rotation or foreign material   |
|  | Meter wire not installed securely into three pin connector   | Verify meter cable wires are installed securely into three pin connector labeled METER  |
|  | Defective meter  | Replace Meter   |
|  | Defective PC Board   | Replace PC Board  |

| PROBLEM  | POSSIBLE CAUSE  | SOLUTION  |
|--|---|---|
| Control valve regenerates at wrong time of day   | Power outage  | Reset time of day. If PC Board has battery backup present the battery may be depleted. See Front Cover and Drive Assembly drawing for instructions. |
|  | Time of day not set correctly                                   | Reset to correct time of day  |
|  | Time of regeneration set incorrectly                            | Reset regeneration time   |
|  | Control valve set at “on 0” (immediate regeneration)            | Check programming settings and reset to NORMAL (for a delayed regeneration time)  |
|  | Control valve set at “NORMAL + on 0” (delayed and/or immediate) | Check programming settings and reset to NORMAL (for a delayed regeneration time)  |
| Time of day flashes on and off   | Power Outage  | Reset time of day. If PC Board has battery backup present the battery may be depleted. See Front Cover and Drive Assembly drawing for instructions. |
| Control valve does not regenerate automatically when the REGEN button is depressed and held          | Broken drive gear or drive cap assembly                         | Replace drive gear or drive cap assembly  |
|  | Broken Piston Rod   | Replace Piston Rod  |
|  | Defective PC Board  | Replace PC Board  |
| Control valve does not regenerate automatically but does when the REGEN button is depressed and held | Bypass valve in bypass position                                 | Turn bypass handles to place bypass in service position   |
|  | Meter is not connected to meter connection on PC Board          | Connect meter to three pin connection labeled METER on PC Board   |
|  | Restricted/ stalled meter turbine                               | Remove meter and check for rotation or foreign material   |
|  | Incorrect programming   | Check for programming error   |
|  | Meter wire not installed securely into three pin connector      | Verify meter cable wires are installed securely into three pin connector labeled METER  |
|  | Defective meter   | Replace meter   |
|  | Defective PC Board  | Replace PC Board  |
| Water running to drain   | Power outage during regeneration                                | Upon power being restored control will finish the remaining regeneration time. Reset time of day.   |
|  | Damaged seal/stack assembly                                     | Replace seal/sack assembly  |
|  | Piston assembly failure   | Replace piston assembly   |
|  | Drive cap assembly not tightened in properly                    | Re-tighten the drive cap assembly   |



| PROBLEM  | POSSIBLE CAUSE   | SOLUTION   |
|--|--|--|
| <b>E1001</b> Error Message: Control valve motor ran too short and was unable to find the next cycle position and stalled | Motor not inserted full to engage pinion, motor wires broken or disconnected                               | Disconnect power, make sure motor is fully engaged, check for broken wires, make sure two pin connector on motor is connected to the two pin connection on the PC Board labeled MOTOR. Press and hold SET and DOWN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect. |
|  | PC Board not properly snapped into drive bracket   | Properly snap PC Board into drive bracket and then press and hold SET and DOWN buttons for 3 seconds. to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.  |
|  | Missing reduction gears  | Replace missing gears  |
| <b>E1002</b> Error Message: Control valve motor ran too long and was unable to find the next cycle position and stalled  | Foreign material is lodged in control valve  | Open up control valve and pull out piston assembly and seal/ stack assembly for inspection. Press and hold SET and DOWN buttons for 3 seconds or disconnect power supply from PC Board for 5 seconds and then reconnect.   |
|  | Mechanical binding   | Check piston and seal/ stack assembly, check reduction gears, check drive bracket and main drive gear interface. Press and hold SET and DOWN buttons for 3 seconds or disconnect power supply from PC Board for 5 seconds and then reconnect.  |
|  | Main drive gear too tight  | Loosen main drive gear. Press and hold SET and DOWN buttons for 3 seconds or disconnect power supply from PC Board for 5 secs then reconnect.  |
|  | Improper voltage being delivered to PC Board   | Verify that proper voltage is being supplied. Press and hold SET and DOWN buttons for 3 seconds or disconnect power supply from PC Board for 5 seconds and then reconnect.   |
| <b>E1003</b> Error Message: Control valve motor ran too long and was unable to find the next cycle position              | Motor failure during a regeneration  | Check motor connections. Press and hold SET and DOWN buttons for 3 seconds or disconnect power supply from PC Board for 5 seconds and then reconnect.  |
|  | Foreign matter built up on piston and stack assemblies creating friction and drag enough to time out motor | Replace piston and stack assemblies. Press and hold SET and DOWN buttons for 3 seconds or disconnect power supply from PC Board for 5 seconds and then reconnect.  |
|  | Drive bracket not snapped in properly and out enough that reduction gears and drive gear do not interface  | Snap drive bracket in properly. Press and hold SET and DOWN buttons for 3 seconds or disconnect power supply from PC Board for 5 seconds and then reconnect.   |
| <b>E1004</b> Error Message: Control valve motor ran too long and timed out trying to reach home position                 | Drive bracket not snapped in properly and out enough that reduction gears and drive gear do not interface  | Snap drive bracket in properly. Press and hold SET and DOWN buttons for 3 seconds or disconnect power supply from PC Board for 5 seconds and then reconnect.   |

# PRODUCT WARRANTY

- SELLER hereby warrants to CUSTOMER that the goods herein described will be free from any liens or encumbrances, that good title to said goods will be conveyed to CUSTOMER by sale of same.

SELLER warrants materials of its own manufacture against defects in material and workmanship under normal conditions of usage and service for one year from whichever of the following events occurs first:

- First use of the system
- Three (3) months following date of shipment from Vista.

Materials not manufactured by seller receive only such warranty, if any, of the manufacturer thereof and which are hereby assigned to CUSTOMER without recourse to SELLER.

SELLER'S obligation under this warranty is limited to and shall be fully discharged by repairing or replacing any defective part FOB its works. SELLER shall not be liable for repair or alterations made without SELLER's prior written approval; for membrane elements becoming plugged by suspended matter, precipitates, or biological growth; or failure to properly maintain the element. SELLER shall not be liable for damages or delays caused by defective material. Elements returned to SELLER for warranty examination must be shipped freight prepaid.

- **SELLER'S Liability.** SELLER SHALL NOT BE LIABLE FOR PROSPECTIVE PROFITS OR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, NOR SHALL RECOVERY OF ANY KIND AGAINST SELLER BE GREATER IN AMOUNT THAN THE PURCHASE PRICE OF THE SPECIFIC GOODS SOLD AND CAUSING THE ALLEGED DAMAGE, WHETHER SUCH CLAIM BE BASED ON CONTRACT OR TORT; provided, however, the aforesaid to the contrary notwithstanding, SELLER shall not be liable for any bodily injuries or property damage directly caused by its willful, wanton or negligent acts.
- **All Other Warranties and Damages.** THERE ARE NO WARRANTIES ESTABLISHED, EXPRESS OR IMPLIED OR STATUTORY, INCLUDING THE WARRANTY OF MERCHANTABILITY, EXCEPT THOSE SET FORTH ABOVE OR ANY PERFORMANCE WARRANTY WHICH IS ATTACHED TO THIS ORDER.
- **Permits, Ordinances and Code Compliance.** CUSTOMER has full responsibility for obtaining any licenses, permits and inspections required with respect to installation and use of the goods herein described.
- **Governing Law.** Any agreement based upon this Order and the obligations thereby imposed on SELLER and CUSTOMER shall be governed by and construed according to the laws of the State of California.